NPOESS Data Exploitation (NDE)

Project Plan

Revision Aug. 7, 06~~Jul. 28, 06~~

Prepared by:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration (NOAA)
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A INTRODUCTION

i. Executive Summary

The NPOESS Data Exploitation (NDE) Project will link the civilian environmental satellite information users to data collected by the National Polar-orbiting Operational Environmental Satellite System (NPOESS). NPOESS products will start replacing the data from existing Polar-orbiting Operational Environmental Satellites (POES) systems in 2010 and will continue providing NOAA's polar-orbiting satellite observations until approximately 2020.

To reduce the risks associated with the introduction of NPOESS' innovative technologies, an NPOESS Preparatory Project (NPP) satellite will be placed in orbit, starting to supply prototypical NPOESS products in late 2009. Initial funding for the NDE project commenced in October of 2005 with essential system upgrades within NESDIS to prepare for NPP. The NPOESS program will continue beyond the year 2020 to ensure continuous service from a complete constellation of two operational NPOESS satellites. The NDE project will continue in parallel throughout the entire period of the NPOESS program.

NPOESS provides a new generation of remote sensing and satellite technology. NPOESS data volumes will peak at about 6 terabytes per day in 2016 (tbc). This will require more than a 100-fold increase in NOAA data management capacity. The data will be delivered much more quickly than current satellite observations, arriving within 30 minutes of observation. Both the volume expansion and the improved timeliness require NOAA to upgrade its satellite product generation and distribution infrastructure in major ways.

NPOESS' improved sensors will provide data at higher resolution and in spectral bands previously unavailable. Applications of these data promise to have significant impacts on the accuracy of weather forecast models and the analysis of both sea and land surfaces for daily analyses and retrospective climate studies.

NDE will be conducted as a demonstration project in which the procedures it establishes will be evaluated as candidates for wider adoption as best practices. NDE will employ an enterprise project approach, developing functionality to be shared across NOAA systems to reduce costs, risks, and to minimize redundancy. NDE will use the latest proven methods, tools and techniques to establish key elements of NOAA's 21st Century satellite data management capability.

ii. Preface

This document is the NOAA/NESDIS publication of the NOAA NPOESS Data Exploitation (NDE) Integrated Project Plan. It describes the concepts that will guide NOAA's management and control of activities in support of the distribution, additional processing, and utilization of NPOESS instrument data. The document sets forth the basis for plan decisions as well as the plans themselves.

Through the winter of 2005-6, the NPOESS program was reviewed using the analytical framework of the Nunn-McCurdy amendment.1 These studies resulted in decisions regarding the number of satellites, launch dates, and instrument packages. The impact of these NPOESS program adjustments are expressed in Section 6 Project Schedule

This is Version 2.0 (DCN OSDNDEPP 2.0)

Updates and revisions to this document will be produced and controlled by NOAA/NESDIS/OSD.

[1] Report No. 97-311 DEPARTMENT OF DEFENSE AUTHORIZATION ACT, 1982 The language of the amendment calls for the termination of weapons programs whose total costs grew by more than 25 percent above original estimates (unless they were certified as critical systems by the Secretary of Defense) or if the cost growth was attributable to certain specified changes in the program. These thresholds were reached in the NPOESS program by the fall of 2005. NPOESS came under the jurisdiction of the amendment because DoD is a project owner and because the NPOESS data supports weapons systems.

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vi. Applicable Documents and References

- NOAA's NPOESS Data Exploitation Charter http://projects.osd.noaa.gov/nde
- NPOESS IPO, Integrated Operational Requirements Document I (IORD II), version 6, 2002.
- Information Processing Division National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Concept Of Operations, Baseline Issue, June 20, 2002,

Version 1 http://216.33.118.202/EPSData/DOC/Synopses/3055/NOAA-CEMSCS-04-04-2003/AppendixE.pdf

- National Oceanic And Atmospheric Administration Information Quality Guidelines, September 30, 2002, http://www.noaanews.noaa.gov/stories/iq.htm
- Concept of Operations (CONOPS) for the National polar-orbiting Operational Environmental Satellite System (NPOESS) Program, Version 1.2, September 15, 2003, NPOESS DATA EXPLOITATION (NDE) SYSTEM REQUIREMENTS, 13 August 2004
- NPOESS DATA EXPLOITATION (NDE) Concept of Operations, V2, March 14, 2006 NDE Public Documents Web Page
- NDE's ESPC Requirements, June 2005, NDE Public Documents Web Page

- **POLICY ON TRANSITION OF RESEARCH TO APPLICATION, NAO 216-105,** Issued: 05/31/05; Effective: 05/17/05

1. OVERVIEW

1.1 Short Description

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) will replace the National Oceanic and Atmospheric Administration (NOAA) Polar-orbiting Operational Environmental Satellite (POES) Program and the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP). In the next decade, NPOESS will provide environmental remote sensing capability for both civilian and military applications. In addition, the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) will operate polar-orbiting satellites under their Meteorological Operational (METOP) program that will complement NPOESS data.

NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) operates United States' environmental satellites, including command and control, ground systems, data processing, and distribution to end-users of the data.

NPOESS will provide data to four central processing facilities, called "Centrals," via its Interface Data Processing Segment (IDPS) and to remote field terminals via direct satellite-to-ground communications links. The Centrals will be responsible for providing NPOESS global coverage System Mission Data (SMD) to environmental satellite users. Field terminals will provide real-time access to regional coverage data feeds directly from NPOESS satellites.

NESDIS will operate the NOAA Central. The Air Force Weather Agency (AFWA), Fleet Numerical Meteorology and Oceanography Center (FNMOC), and Naval Oceanographic Office (NAVOCEANO) will operate the other three Centrals. The distribution of the NPOESS products to the civilian community will be the responsibility of the NPOESS Data Exploitation (NDE) system at the NOAA Central.

The NDE system will receive data from the NPOESS IDPS, distribute it as received according to user needs, process and package it to meet user requirements, ensure appropriate information is archived, distribute data to authorized users, and provide customer service. NDE will have a system management capability that supports management and control of the operational system. In addition, NDE will have a development test-bed capability that will permit development, modification, and system testing without risk to the operational system.

NOAA and other civilian users may need to update their systems to use the new polar satellite data provided by NPOESS. Without NDE or equivalent data conversion to use NPOESS' Hierarchical Data Format (HDF) version 5 (HDF5) data, NOAA systems like Numerical Weather Prediction and the Advanced Weather Interactive Processing System (AWIPS) will be unable to exploit the NPOESS products. The new data may have performance impacts as well. As existing instruments are decommissioned, the polar satellite community must transition to NPOESS data. NDE will support the transition.

NDE will address the data conversion and other key requirements needed to continue mission critical applications as well as identify new requirements to improve operations due to new instrumentation and capability. This project plan will provide the structure and framework to guide the NDE project through its lifecycle.

1.2 Assumptions and Constraints

The design of NPOESS embodies significant change in the way polar satellite data are collected and processed. The foremost assumptions shaping this project, therefore, are based on the NPOESS program.

NESDIS Systems Must Be Upgraded

NPOESS will provide new and improved remote sensing data in comparison to existing polar satellites. It will have new high resolution instruments and a new ground station architecture that will provide more data at a faster rate. By 2016, when the 2 satellite NPOESS constellation is operational (tbc), NPOESS will make about 6 terabytes of data available to NESDIS every day. The products will be available for assimilation into user systems within minutes of observation instead of hours.

These changes are so extensive that NESDIS must implement fundamental and widespread improvements to its data management systems, telecommunications infrastructure, and distribution networks in order to successfully deliver NPOESS products.

NPOESS Products Must Be Enhanced

NPOESS products satisfy the requirements of the U.S. Department of Commerce and the U.S. Department of Defense. Each of the Centrals will be provided with data in accordance with the Integrated Operational Requirements Document (IORD-II, dated January 14, 2002). A fundamental design assumption of NPOESS is that each Central will modify and redistribute the products to satisfy the needs of its customers. NDE will manage two categories of product enhancement: “tailoring” and “NOAA-unique product” development.

In tailoring activities, versions of NPOESS Data Records are provided in alternative formats and views. For example, all of the NPOESS products will be delivered to NESDIS in Hierarchical Data Format 5 (HDF5), a standard used by only a few of NESDIS’ customers. NDE will reformat the data for these customers before dissemination. Other forms of tailoring include alternative map projections, coverage areas, aggregations, grids, and compression approaches. Whenever possible, NDE will provide the software to enable the end users to do the tailoring on their own systems.

NESDIS currently provides its customers with approximately 270 environmental data products derived from polar satellite observations. Many of these products are different views of the same data. When fully operational, NPOESS satellites will deliver over 150 products. NESDIS’s mission requires an extension of similar tailoring capabilities into the NPOESS era.

NOAA-unique product development is necessary to support missions that are specific to NOAA, as opposed to data used by all Centrals. NOAA-unique products are augmented environmental products constructed from NPOESS Data Records. They will be generated by procedures (e.g., algorithms) that use NPOESS Data Records (xDRs) as a basis of products containing data values that are different from those in the xDRs as received from NPOESS. NOAA-unique products may be generated by combining products from different data sources to provide other environmental information.

2 PROJECT SCOPE

The NDE project consists of an interdependent group of people who engage in processes to develop an NDE system that will include all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services, and personnel required for operations and support.

2.1 Project Mission, Goals, and Objectives

NDE'S primary mission is to provide products derived from NPOESS observations to NOAA's operational and climate communities and other civilian customers. In order to fulfill the mission, NDE will acquire the resources necessary to achieve the following objectives:

- Disseminate NPOESS Data Records to customers
- Generate and disseminate tailored NPOESS Data Records (versions of NPOESS Data Records in previously agreed alternative formats and views)
- Generate and disseminate NOAA-unique products (augmented environmental products constructed from NPOESS Data Records)
- Deliver NOAA-unique products and associated metadata to the NOAA Long-Term Archive
- Provide services to customers, including a Help Desk, NDE product training, product enhancement, and implementation support across NOAA
- Coordinate NPOESS-related activities across NOAA
  - Assist with planning for the implementation of NPOESS data by user systems
  - Ensure end-user preparedness for NPOESS data
- Develop a sustainable system that meets its customer needs
- Provide software for NPOESS Data Record format conversion and other data manipulations

These objectives are aligned with NOAA's strategic goals. Within the **Ecosystem** Mission Goal, for example, ocean color and sea-surface temperature (SST) products are needed for public health (harmful algal blooms), protected species, fisheries management (commercial and recreational), and coastal zone management (pollution, spills/dumping, toxins, nutrification) efforts.

Within the **Weather and Water** Mission Goal, as well as in support of the Commerce and Transportation Goal, Environmental Data Records (EDRs) are needed to support real-time assessments and short-to-medium range warnings of environmental conditions that may endanger human safety and health, and safe **transportation**. For example, atmospheric EDRs such as temperature, moisture and cloud optical properties are used in the NWS Advanced Weather Interactive Processing System (AWIPS) by the weather forecast offices to support real-time assessments of convective activity which provides critical information used in issuing severe weather warnings, including aircraft turbulence to the aviation community.

Land EDRs are used to assess vegetation and drought conditions and provide critical information for sustaining and assessing changes in the health of the Nation's agriculture industry. Furthermore, land EDRs provides information on fire location and burn areas that are critical to the United States Forest Service to manage forest fires. These EDRs are also used in emission models to assess the impact of fire emissions on air quality.

Ocean color and sea-surface temperature (SST) imagery facilitates the operational assessment of currents and eddies, directly supporting, for example, recreational boaters, the offshore oil/minerals industry, and tropical cyclone analyses, as well as Department of Defense requirements (e.g. the acoustical environment for submarines). Also, ocean vector winds products are used by the National Weather Service's National Centers for Environmental Prediction (NCEP) Ocean Prediction Center (OPC) and the weather forecast offices for the development of high wind and wave warnings, as well as input for the operational wave forecast modeling. NPOESS products will be used in such areas as the National Ice Center (NIC) for iceberg and ice edge detection, as well as by the offshore oil/mineral industry as previously noted.

Within the **Climate** Mission Goal, EDRs are required for the formulation of Climate Data Records (CDRs) and the assessment of seasonal-to-interdecadal variability (such as ocean color and SST for El Niño, Pacific Decadal Oscillation, atmospheric temperature, water vapor and cloud, etc).

In summary, the examples given above clearly demonstrate NOAA's extensive need for NPOESS products in addition to direct radiance assimilation used for numerical weather prediction. Furthermore, with NPOESS latency of 28 minutes or less (observation time to product distribution) the utilization of NPOESS products for real-time assessments will increase.

NDE is also a project that cuts across the mission goals, playing an important part in NOAA's continuing effort to improve its **Core Capabilities**. NDE will serve as a demonstration project, developing new methods and procedures while implementing technologies intended for use by systems across the NOAA enterprise. NDE will be the forerunner for NESDIS projects that must achieve these mandated objectives:

- Integrating Global Environmental Observations and Data Management
- Ensuring Sound, State-of-the-Art Research
- Developing, Valuing, and Sustaining a World-Class Workforce

2.2 NDE as a Transition Project

In 2005, NOAA issued policies and procedures to address the challenges of managing the transition of research products into operational environments.[2] NDE has been identified as a "Transition" project because its resources are dedicated to both sides of the problem. The project provides funding and management oversight for research projects that are discovering operational applications for NPP and NPOESS observations. The project also funds and manages the acquisition of the developmental, testing and operational information systems in which the data management and the dissemination of the observations to operational centers will be accomplished.

The policies provide the NOAA Executive Council (NEC) with "a mechanism for systematically reviewing all research annually in order to identify research to be transferred, establish a structure for managing research deemed ready for transfer, and delineat*(ing)* the roles and responsibilities necessary for those at NOAA to accomplish such transfers." Accordingly NDE has established the NDE Transition Team whose members represent the NOAA research and operational communities that are associated with NPP and NPOESS. The team's initial task is the formulation of the "NDE Transition Plan" using a template and

[2] **POLICY ON TRANSITION OF RESEARCH TO APPLICATION, NAO 216-105,** Issued: 05/31/05; Effective: 05/17/05

guidance provided by the NOAA Transition Board (NTB). A draft of that document will be submitted for review by the end of September, 2006.

Future releases of this document ("NDE Project Plan") will reflect the content of the Transition Plan and will provide a link to it in Section 8.1.3 as one of several processes used by NDE for planning.

2.3 Project Context

Figure 1, a Project Context diagram, depicts the major interfaces between NDE and other entities.

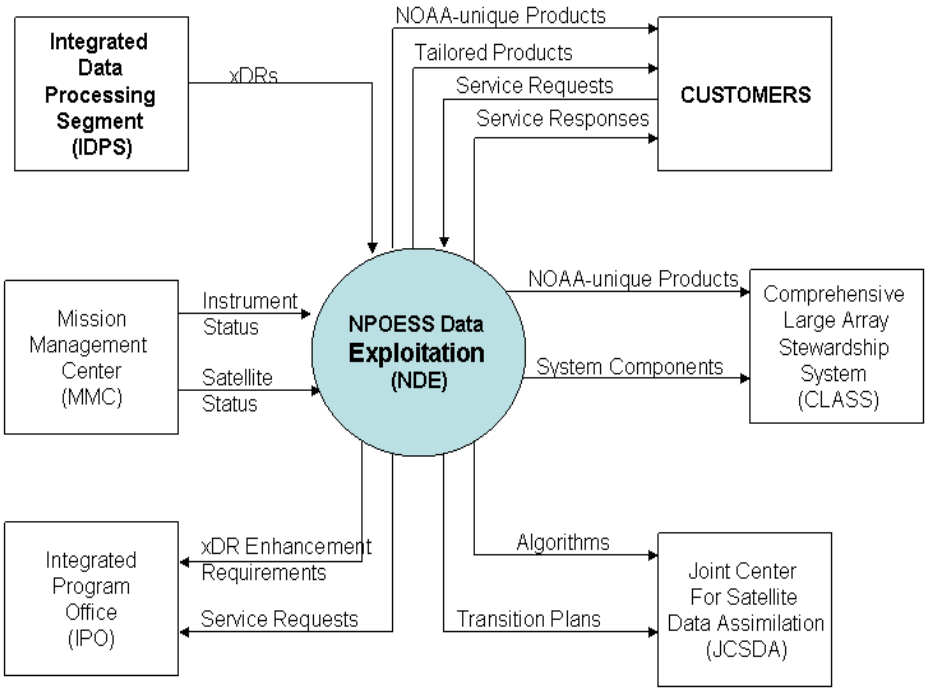


Figure 1: Project Context

2.3.1 The Interface Data Processing Segment (IDPS)

IDPS is an automated system that provides NDE with Data Records from the NPOESS satellites IDPS will provide four types of Data Record (xDRs). These record types are categorized as follows.

Raw Data Record (RDR) – An RDR is the IDPS first phase product. It is a full resolution digital sensor data file, time referenced, with radiometric and geometric calibration coefficients appended, but not applied, to the data. Aggregates (sums or weighted averages) of detector samples are considered to be full resolution data if the aggregation is normally performed to meet resolution and other requirements. [Sensor data will be unprocessed with the following exceptions: time delay and integration, detector array non-uniformity correction (i.e., offset and responsivity equalization), and data compression.]

Temperature Data Record (TDR) – A TDR is an intermediate IDPS product created from the application of algorithms to microwave sensor RDRs. It consists of geolocated, antenna temperatures with all relevant calibration data counts and ephemeris data. TDRs also provide an audit trail from the raw data (RDR) to the TDR.

Sensor Data Record (SDR) – A SDR is an intermediate IDPS product resulting from the application of an algorithm to non-microwave sensor RDRs. It consists of geolocated and calibrated brightness temperatures/radiances with associated ephemeris data. SDRs provide an audit trail from the raw data (RDR) to the SDR.

Environmental Data Record (EDR) - An EDR is the end product of complete IDPS processing. It is a collection of data that represents one or more related environmental variables, generally referenced to the source location. Environmental variables are reported in physically significant units at the source, and geometrically referenced with respect to the Earth or another appropriate coordinate reference system.

Each EDR will include metadata, data that describes and provides context for the subject data.

Intermediate Product (IP) - An IP is produced by the IDPS during the process of generating an EDR. Although not specified in the IORD, a selected group of IPs will be made available as end products on the IDPS.

The IDP system is managed by a contractor with government supervision provided by the IPO.

2.3.2 Customers

The NDE project is organized to provide environmental products derived from NPOESS instruments to two categories of customers: civilian users and government organizations.

Civilian users are a broad group, encompassing educational institutions, research organizations, industry, and the general public. This category includes foreign governments with whom NOAA has satellite data sharing agreements.

Government agencies include the following:

- National Weather Service (NWS)
- National Ocean Service (NOS),
- Office of Oceanic and Atmospheric Research (OAR),
- National Marine Fisheries Service (NMFS)
- NOAA United States Mission Control Center (USMCC)
- Department of Agriculture (NESDIS)
- Federal Aviation Administration (FAA)
- Department of State
- National Aeronautic and Space Administration (NASA)

Foreign government customers include:

- United Kingdom Meteorology Office (UKMetO)
- European Center for Medium range Weather Forecasting (ECMWF)
- MeteoFrance
- Japan Meteorological Agency (JMA)
- German Meteorological Service
- Australian Board of Meteorology

NOAA customers will be the recipients of data from NPOESS in negotiated data formats. They will, in some cases, receive products that have been tailored by NDE. These tailored products provide alternative views of the data record to facilitate assimilation by the customers' systems.

NDE will receive Search and Rescue Satellite Aided Tracking (SARSAT) distress signals from the NPOESS satellites. The signals will be routed to NOAA's U.S. Mission Control Center (USMCC) in Suitland, Maryland without any tailoring.

Outside of NOAA, the primary customers of NPOESS products will be in the Department of Agriculture (DoA), the Federal Aviation Administration (FAA), and the Department of State.

NDE will process and respond to various kinds of service requests from Customers. The goal is a smooth and seamless transition into the NPOESS era.

2.3.3 Integrated Program Office (IPO)

This is an umbrella management organization with responsibility for providing, launching, and controlling the NPOESS satellites as well as the ground systems necessary for capturing, processing, and delivering the data to NDE.

In the context of NDE, the IPO oversees a change control function. It will receive NDE Service Requests and xDR enhancement requirements and will need to respond to NDE Service Requests.

2.4.4 Mission Management Center (MMC)

The MMC is managed by a contractor with IPO supervision. It is responsible for the command and control of the NPOESS satellites. Its primary system, the Enterprise Management System, will provide NDE with information about changes to the spacecraft that might influence the values of the data (e.g., calibration and validation).

2.4.5 Comprehensive Large Array-data Stewardship System (CLASS)

Comprehensive Large Array-data Stewardship System (CLASS) acquires and develops a long-term archive (LTA) of all NOAA environmental products from its satellites, polar or geostationary, and from *in situ* sources. In the context of NDE, its mission is to archive NOAA-unique products that NDE has created by augmenting NPOESS products. All of NDE's system components (source code, documentation, etc.) used in product generation will also be archived to support future reprocessing and research.

CLASS will have a separate interface to the IDPS at the NOAA Central for archiving xDRs and associated data. The interface shown in the diagram is solely for NDE's NOAA-unique products.

2.3.6 Joint Center for Satellite Data Assimilation (JCSDA)

This Program supports assimilation of atmospheric products derived from NPOESS satellites into NWS operations more quickly and effectively. In the context of NDE, as NOAA develops algorithms to be used by NDE, they will be provided to the JCSDA to support the development of common algorithms for use by all the NPOESS customers and by the other Centrals. To ensure that operational users are ready and eager to use NPOESS data on day one of its availability, NDE will apprise JCSDA of plans for the introduction of new products.

3 PROJECT ORGANIZATIONAL VIEWS

3.1 NOAA Line Offices

The primary NOAA government customers for satellite data products, the Line Offices of NOAA, are shown in the lowest tier of the NOAA organization chart in Figure 2.

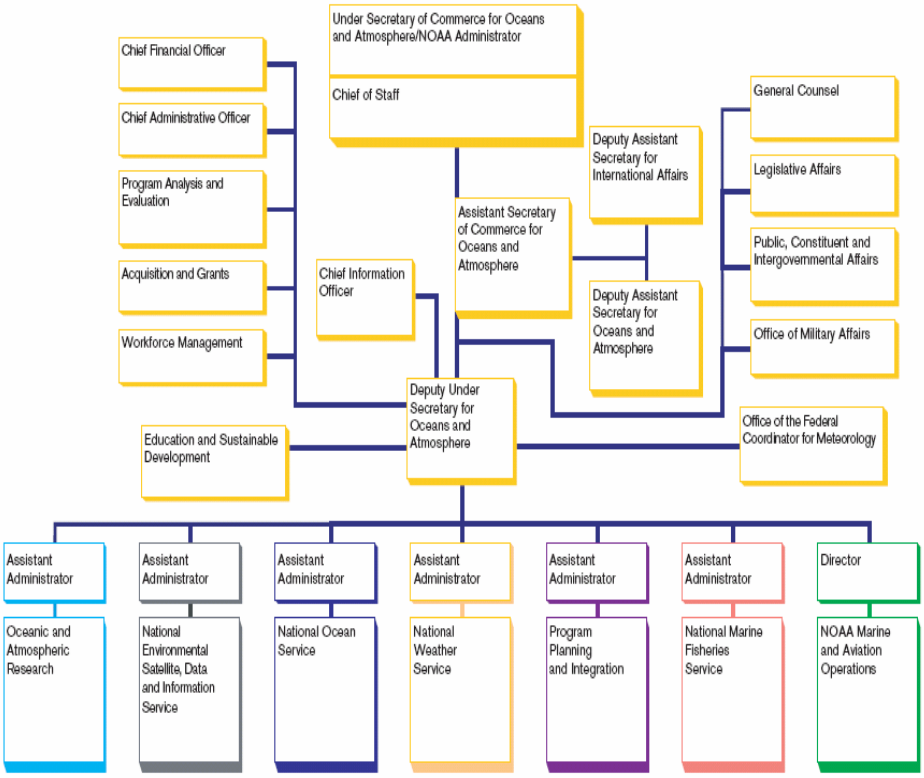


Figure 2: NOAA Organization Chart

3.2 NESDIS

As shown in Figure 3, three Offices within NESDIS will carry out the majority of NDE project tasks: the Office of Satellite Data Processing and Distribution (OSDPD), the Center for Satellite Applications and Research (STAR), and The Office of Systems Development (OSD).

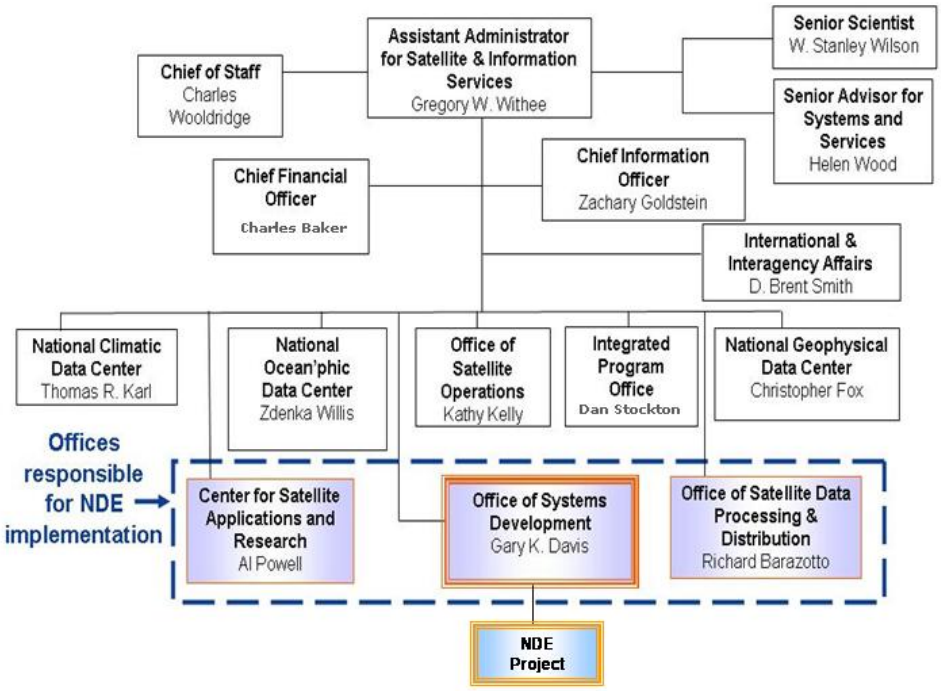


Figure 3: NESDIS Organization Chart

3.2.1 OSDPD

The Office of Satellite Data Processing and Distribution (OSDPD) acquires and manages the resources that will comprise the NOAA NPOESS operational data processing and dissemination infrastructure. The framework for these efforts is the Environmental Satellite-data Processing Center (ESPC). OSDPD manages and controls ESPC, relying on a System Development Team that collaborates with the NDE System Architect as well as OSDPD Management to assist with important design and development activities.

ESPC's responsibilities include:

- Management of the NDE product generation, distribution, system test, and development infrastructures
  - Procure, install, and integrate all necessary NDE infrastructure elements in a timely fashion
  - Manage scheduled upgrades of infrastructure elements
  - Operate NDE product generation applications within agreed performance parameters (e.g., Customer Service Agreements [CSAs])
  - Perform unscheduled maintenance of any system element if such changes are determined to be necessary in order for the system to function according to previously agreed requirements
  - Provide Customer Service including:
    - Help Desk

        - Service Request Management
        - Customer liaison with product specialists
        - Directing customers to NDE training
    - Provide Order Management services including:
        - Providing the means for Customers to select products
        - Providing the means for Customers to select tailoring options
        - Ensuring the timely dissemination of ordered products
        - Tracking Orders

- Operation of the System Test Environment
    - Implement a stand-alone System Test Environment
        - Replicate all significant characteristics of the Operational Environment
        - Provide a temporary backup environment in which products can be generated and distributed to customers in the event of operational environment failure
        - Evaluate candidate system elements for operational fitness, performing appropriate
            - Parallel tests
            - Stress Tests
            - Regression Tests
    - Certify candidate system elements for operational fitness

3.2.2 STAR

NESDIS' Center of Satellite Applications & Research (STAR) conducts research on the use of satellite data for monitoring meteorological, climatological and oceanographic environmental characteristics. Scientists working for STAR develop algorithms, develop software designs, write software specifications, guide product quality assurance, and advise the IPO regarding their long experience with polar satellite products. They are organized as 3 Divisions:

- Satellite Meteorology and Climatology Division, conducts research on the use of satellite data for monitoring meteorological, climatological and environmental characteristics.
- Satellite Oceanography Division of NESDIS/STAR provides the primary research and development support for oceanic remote sensing within NOAA.
- Cooperative Research Programs, through which university and other external scientists can collaborate with the STAR scientists.

3.2.3 OSD

Overall responsibility for managing the NDE Project rests with the Office of Systems Development (OSD). OSD oversees procurement and acquisition tasks, develops the plans, schedules and budgets that shape the project, monitors and controls project progress, coordinates the activities of the other participating agencies, and represents the project to external organizations.

Figure 4 illustrates the fundamental responsibilities of the NESDIS Offices to the NDE project, three overlapping domains: Science, Data Processing, and Management.

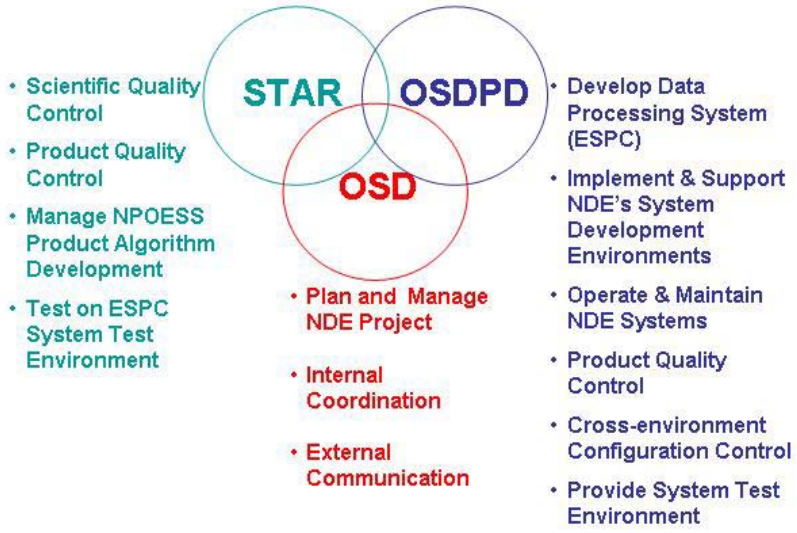


Figure 4: NESDIS Office Roles

4 ROLES AND RESPONSIBILITIES

Figure 5 depicts the organization of the NDE Project. The roles and responsibilities of each manager and team are described below.

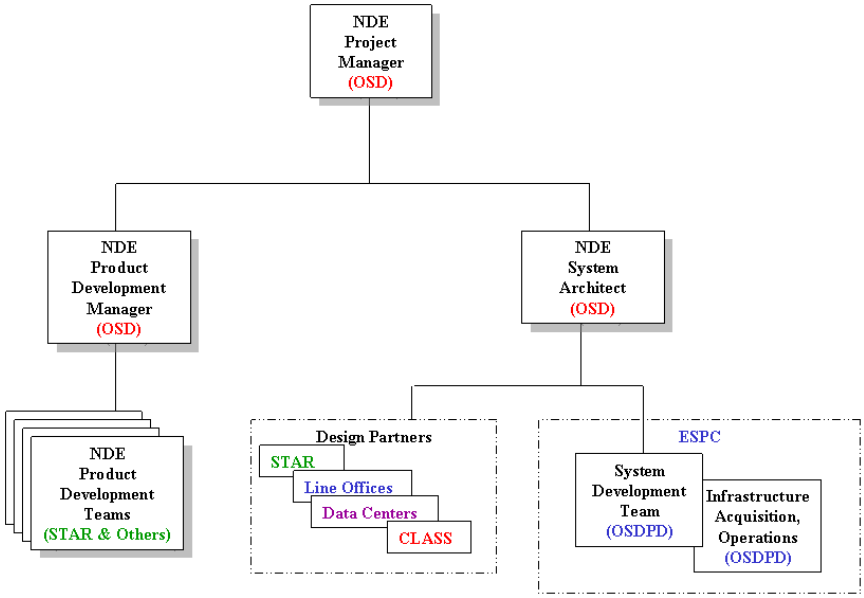


Figure 5: NDE Organization Chart

4.1 NDE Project Manager

The NDE Project Manager's responsibilities include:

- Financial Management:
  - Submission of NDE budget requests to NESDIS, NOAA, DOC, and OMB
  - Accounting of NDE financial resources
  - Disbursement of NDE funds to contractors, STAR, OSDPD, and other NOAA organizations supporting the project
- Project Control
  - Selection of Product Development projects
  - Coordination of Milestone Review and Approval procedures
  - Supervision of Team Leaders (other than PD Teams)
  - Monitoring Work Schedules and Team performance
  - Coordination of cross-Team activities
- NOAA Program Support
  - Participate in the definition of ESPC requirements
  - Participate in the selection of ESPC contractors
  - Provide status reports to OSD's Polar Program Manager

        - Status on organizational activities (e.g., procurements) / Schedules
        - Budget inputs/spend plans
    - Provide liaison to the Integrated Program Office (IPO)
        - Provides participants to key NPOESS activities, such as Program and Document Reviews, Key Meetings, Customer Forum
- NOAA community outreach
    - Provide briefings on NPOESS activities/progress
    - Solicit participation in NDE developments
- Prepare and conduct regular NDE meetings
    - Status of the NDE Project
    - Reports of Management Activities
    - Reports from Matrixed Teams

4.2 NDE System Architect

The NDE System Architect reports directly to the NDE Project Manager. The associated responsibilities include the following:

- Cooperates with OSDPD and STAR on the development of contract packages to implement NDE system architecture and ensures the contract packages are properly processed.
- Participates in routine contractor updates on NDE program efforts.
- Advises ESPC's NDE System Development Team
    - Communicates NDE's system design expectations to the team (i.e., standards, best practices, technology directions, etc.)
    - Approves project plans
    - Reviews and approves deliverables identified on the plans
    - Monitors project status
    - Participates, with ESPC management, in determining corrective actions to be taken in the event of project problems (i.e., schedule slippages, budget overruns, substandard deliverables, etc.)
    - Participates, with ESPC management, in follow-on activities to assess the effectiveness of corrective actions
- Advises the ESPC's NDE System Development Team regarding Software Engineering methods:
    - Repeatable framework for project planning and control
    - Guidance on best practices and standards
    - Guidance for customer involvement and other roles and responsibilities
- Advises the ESPC's NDE System Development Team regarding Software Engineering tools, in order to:
    - Promote use of graphics in models
    - Provide environment for requirements validation and tracking
    - Provide repository of reusable objects
- Advises the ESPC's NDE System Development Team regarding software development technologies, in order to:
    - Reduce risks associated with technology upgrades
    - Increase the population of skilled practitioners
    - Promote private sector advancements
- Communicates NDE's infrastructure requirements to ESPC to ensure timely installation of tools and equipment.
    - Performance

  - Capacity
  - Dates needed
- Coordinates NDE's integration of NESDIS-wide data processing capabilities
  - Monitor the activities of NESDIS data processing development efforts (e.g., CollabSTARtive Environment Teams) by:
    - Comprehensive Large Array-data Stewardship System (CLASS)
    - STAR system upgrade teams
    - System upgrade activities taking place at the NESDIS Data Centers:
      - National Climatic Data Center (NCDC)
      - National Ocean Data Center (NODC)
      - National Geophysical Data Center (NGDC)
  - Identify opportunities for NDE to adopt the practices and capabilities being developed by the other teams
  - Communicate NDE plans to the other teams
    - Agree upon system standards
    - Present standards to NESDIS' Information Technology Architecture Team (ITAT) for approval
  - Ensure compatibility between algorithm development environments, the System Test environment, and the ESPC operational environments (i.e., accelerate Research to Operations)
  - Participate in Team-level quality control reviews as appropriate
- System Quality Control
  - Participates in NDE Standards Committee activities
    - Agree upon system standards
    - Present standards to NESDIS' Information Technology Architecture Team (ITAT) for approval
  - Ensures compatibility between algorithm development environments, the System Test environment, and the ESPC operational environments (i.e., accelerate Research to Operations)
  - Participates in Team-level quality control reviews as appropriate
- Develop/revise the NDE documents for Milestone reviews (SRR, PDR, CDR, etc.)
  - Integrated Project Plan
  - Architecture
  - Requirements
  - Concept of Operations
- Tracks the evolution of system features from requirements through operations
- Advises the NDE Project Manager on the risks and costs associated with new requirements

4.3 ESPC's System Development Team

This team consists of contractors who have been engaged to design and develop the NESDIS Environmental Satellite-data Processing Center (ESPC). The NDE Project has provided ESPC with its requirements in the following categories:

- Software Engineering
- Product Generation
- Systems Management
- Infrastructure
- Data Retention and Archive

- Customer Service
- External Interface
- Communications and Distribution

Within ESPC, this team will be established to design and develop a data processing system to meet the stated requirements. The team will function according to the terms of OSDPD's ESPC contract. The NDE System Architect (4.2 above) will provide guidance and supervision of the NDE System Development Team to ensure the timely delivery of system capabilities consistent with the stated requirements. Accordingly, this team will:

- Specify "enterprise" data processing resources to be shared by NDE's product applications. Such resources include:
  - Database management systems (DBMS)
  - Work management and scheduling systems
  - Libraries
  - Object repositories
  - Object repository content
    - Shared data objects (i.e., lookup tables, ancillary data)
    - Shared procedural objects (i.e., utilities, called-modules, subroutines, etc.)
- Specify an architecture for NDE's product generation applications, focusing on
  - Opportunities for reuse, and the sharing of capabilities among diverse NOAA observing systems
  - Performance measures (i.e., test criteria) for executables
  - Information hiding (i.e., invocation of algorithms, functions, reference tables, etc. as modules)
- Participate, with ESPC Management, in the selection of NDE data processing system components specified in the architecture (above)
- Define NDE System Test Certification Standards
  - Regression Test Acceptance Criteria
  - Regression Test Acceptance Specifications
  - Stress Test Acceptance Criteria
  - Stress Test Specifications
  - NDE Test Bed Configuration
    - Test Data
    - Enterprise (Shared) Objects: Shared Procedures, Shared Tables, Utilities, etc.
- Provide assistance, on request, to Product Development Teams
  - Information on Operational Standards
  - Information on System Test and escalation procedures
  - Review of source code

4.4 Product Development Manager

The NDE Product Development Manager will:

- Identify NDE product development projects to exploit NPOESS data in support of NOAA's strategic missions
  - Collect information about product requirements from NOAA customers who represent the Programs of the NOAA Mission Goal Teams
  - Develop integrated views of NDE Products in the context of NOAA's Observing Systems Architecture (NOSA)

  - Obtain agreement from NDE stakeholders on product development priorities and prioritization methods
  - Identify and communicate to stakeholders the constraints that bear on prioritization decisions, such as budget, schedule, dependent projects, technology, and scientific capabilities.
  - Select development efforts that satisfy agreed prioritization criteria
  - Obtain management approval of the selected projects
- Provide guidance and direction to Product Development Teams
  - Obtain funding to finance NDE product development through NDE Project budget
  - Provide guidance to candidate product developers regarding criteria to be applied in selecting recipients of NDE Product Development funding
  - Evaluate the proposals of candidate product developers according to the announced selection criteria
  - Select the product developers
  - Provide funding to NDE product development teams
  - Monitor the status of NDE product development projects
  - Ensure product development teams produce the deliverables, both documentary and executable, required by OSDPD
  - Provide guidance and correction, as appropriate, to product developers
  - Ensure product development plans are appropriate documented.
- Review and approve all contract packages related to product development
- Track and report to NDE Project Manger product development budget execution

4.5 Product Development Teams

A Product Development Team's objective will be the specification and development of algorithms that will operate within the ESPC to provide an operational product. The Product Development Teams conduct research on the use of satellite data for monitoring meteorological, climatological and oceanographic environmental characteristics. Each Team will conduct applied research on the use of NPOESS satellite data for the analysis of significant meteorological and surface-based phenomena. Tasks within the scope of each Product Development Team's responsibility include:

- Development of algorithms for NOAA-unique products and for product tailoring:
  - Collection and documentation of user requirements
  - Specification of algorithm designs
  - Development of algorithm test plans
  - Development of algorithm code
  - Unit and string testing of algorithms
  - Submit executables for System Testing by OSDPD
  - Evaluate data quality during System Testing
  - Correct errors detected during System Testing
- Configuration Management
  - Participate (with OSD and OSDPD) in NDE Standards Committee activities
    - Agree upon system standards
    - Present standards to NESDIS' Information Technology Architecture Team (ITAT) for approval
    - Agree on metadata implementation of NDE products
  - Develop and manage documentation consistent with NESDIS standards

  - Develop executable system components (i.e., algorithms, functions, reference tables, etc.) using NESDIS standard technologies (i.e., Computer languages, DBMS/Object repositories, procedure libraries, documentation libraries, etc.)
- Develop Data Quality evaluation and reporting methods for use during normal operations[3] based upon
  - Gross error checks for data that fall outside of physically realistic ranges (e.g. a minimum, maximum, or maximum change)
  - Comparisons made with other independent sources of the same measurement
  - Examination of individual time series and statistical summaries
  - Application of sensor drift coefficients determined by a comparison of pre- and post-deployment calibrations
  - Visual inspection of the data
  - Timely notification of output quality problems to OSDPD System Management (**NOTE:** The Office of Research and Applications (STAR) (Section 2.3.2) plays an important role in the Quality Control of input from NPOESS. However, because these instrument calibration and product validation activities are funded and managed by the IPO within the NPOESS Program, they are outside the scope of this document.)

5 PROJECT DESCRIPTION

5.1 Project Approach

NDE will use a spiral development approach characterized by successive iterations of development cycles. Each cycle will end by providing customers with a set of NDE products, or a “Release.”

Each cycle will be organized into five phases: Customer Coordination, Design, Construction, Test, and Transition. Each phase will have a set of deliverables. There will be a checkpoint at the end of each phase where deliverables will be reviewed and approved. The checkpoint will mark the transition from one phase to the next. The phase structure of a build cycle is illustrated in Figure 6.

[3] National Oceanic And Atmospheric Administration Information Quality Guidelines, September 30, 2002 http://www.noaanews.noaa.gov/stories/iq.htm

The checkpoint at the end of the Test Phase will be a milestone. It will certify that a Release is ready for operational use.

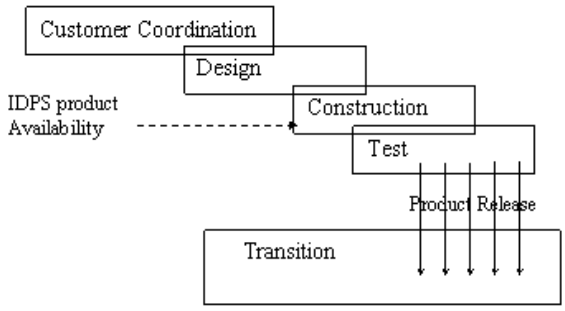


Figure 6: Project Phases

5.2 Customer Coordination Phase

Deliverables:

- NOAA-unique product (science) requirements,
- System (data processing) requirements,
- Customer product tailoring requirements,
- Infrastructure upgrade requirements, Integrated Project Plan for the Build Cycle

Reviews: A formal Phase Completion Review is required (e.g., System Requirements Review [SRR])

During a Customer Coordination Phase, with the assistance of the NDE team, the customers will determine their product priorities, NOAA-unique product requirements, including long-term archive, and which tailoring options they would prefer.

Customers will assess their infrastructures to determine whether upgrades will be necessary to assimilate NPOESS products.

Customers will decide on a preferred delivery method and determine whether changes to their telecommunications will be necessary.

NDE and its customers will develop joint plans to support the implementation of new products. This includes training on NOAA-unique products, tailoring options, and help for use of products and NDE-supplied software tools. Budget responsibilities for these upgrades will be agreed during the conclusion of each Customer Coordination Phase.

NDE will work within established Satellite Products and Services Review Board (SPSRB) and Archive Requirements Working Group (ARWG) processes, as appropriate, to coordinate the development of new products, enhancement to existing products, and provide for long-term archive services of suitable NDE Unique Products.

Customers can submit change requests and new requirements to NDE. They will be accepted at any time, and NDE will actively solicit these requests during Customer Coordination. NDE will have processes to review the change requests, determine new requirements, discuss them with customers, plan for their implementation, and report on status.

5.3 Design Phase

Required Deliverables:

- System Specifications, including
  - Algorithm specifications[4]
  - Unit, User Acceptance, and String Test criteria (see Appendix B: Definitions)
  - Data processing specifications with Unit, User Acceptance, and String Test criteria
  - Internal Interface Specifications (between NDE subsystems)
  - External Interface Specifications (between NDE and external systems)
  - Product tailoring specifications with Unit, User Acceptance, and String Test criteria
- Architecture
  - Assessment of architectural requirements and associated changes
  - Infrastructure component specifications
- Purchase Orders for Infrastructure components (System Test Environment and Operational Environment)
- Training Requirements
- Implementation/Transition Requirements
- Preliminary Test Plans
- Updated Integrated Project Plan for the Build Cycle

Optional Deliverables:

- Algorithm prototypes,
- Data processing system prototypes,
- Product tailoring prototypes

Reviews: During the course of the Phase, frequent detail design reviews and technical walkthroughs are recommended.

A formal Preliminary Design Review (PDR) is required for phase completion. A PDR is an opportunity for the Government to closely observe the System Development Team's hardware and software design. The System Development Team is expected to describe all design changes since the conclusion of the previous (Customer Coordination) Phase. The team may also provide a hardware or hands-on demonstration of some of the preliminary designs to better illustrate important aspects.

A Design Phase will be initiated once the NDE Project Manager is reasonably confident of the completeness of requirements captured during the Customer Coordination Phase. The decision to initiate any phase is a project management prerogative exercised in consideration of many factors. In the case of a Design Phase, the criteria will include:

- Whether the scope of required changes have been defined
- Whether the requirements are supported by a business case (i.e., benefits, goals, risks, etc.)
- Whether the requirements are defined at an appropriate level of detail to support tracking through the project life cycle

During a Design Phase, scientists will develop processing specifications and/or algorithm prototypes. System developers will design the overall system, the software, and other

[4] A "specification" is more detailed than a "requirement." It is documentation that provides sufficient technical information for:

- a developer to code and test a system element
- an acquisitions manager to procure a system element

operational elements that will be necessary to execute the algorithms in an operational environment. The overlap of the Customer Coordination Phase and the Design Phase (Figure 4.2) supports the concept of design approval by NESDIS' stakeholder organizations: OSDPD, STAR, and OSD.

5.4 Construction Phase

Required Deliverables:

- Algorithms that have successfully completed Unit and String Testing
- Data processing components that have successfully completed Unit and String Testing
- Product tailoring components that have successfully completed Unit and String Testing
- Revised specifications (Algorithm and Data Processing)
- System Test Plans
- String and Unit Test Reports
- Preliminary Test Cases and Test Procedures
- Installed and Tested System Test Environment Equipment
- Installed and Tested Operational Environment Equipment
- Training Materials
- Training Test Plans
- Implementation/Transition Plans
- Updated Integrated Project Plan for the Build Cycle

Optional Deliverables:

- Test tools and drivers

Reviews: Successful Completion of Unit and String Testing will precede a formal Critical Design Review (CDR) of relevant, high-level technical documents and the revised Integrated Project Plan. This Review affords Users the opportunity to anticipate their resource commitments for System Testing and their infrastructure readiness for Transition to operations. This review has particular significance for configuration management because all system components and documents should be placed under the strictest controls at the completion of the phase.

A Construction Phase will begin after the following conditions are satisfied:

- Review and approval of Design Phase deliverables
- IDPS provides xDRs to NDE to support validation of operational products

Using IDPS' live data resources as input, science teams will validate products generated/tailored by their algorithms. These modified products will be subjected to simulations of operational conditions in the System Test Environment. System Tests will be conducted to determine performance thresholds (e.g., stress tests under operational workload conditions) of product generation capabilities, distribution maximums, training materials, User Guides, Operational Guides, and the procedures for Security, Control, Backup, and Business Continuity.

There is an overlap shown between the Design Phase and the actual Construction of elements in Figure 4.2 because the Unit and String Testing that takes place during a Construction Phase may identify a need to redesign some system elements.

5.5 Test Phase

Required Deliverables:

- System Test Certificates (all elements)
- Revised specifications (all elements)
- Installed and Tested Operational Equipment
- System Test Logs, Test Reports
- Product Operational Certificates (i.e., the products have successfully completed System Tests)
- Trained Users
- Trained Operations Staff
- Operational Products

Optional Deliverables:
None

Reviews: A formal Post Implementation Review (PIR) is recommended on a product-by-product basis. These should take place a few months after the products have been declared "Operational" so that users have sufficient time to determine their level of satisfaction.

There is an overlap between the Testing and Construction Phases because errors detected in system testing may require reconstruction and redesign. The overlap (Figure 3-1) is also meant to indicate that one set of Configuration Management (CM) standards for system components are applied during both the Construction and the Test Phases.

A Cycle is complete when all of the tailored and NOAA-unique products identified during the Customer Coordination Phase are commissioned as operational after successful System Testing and inspection for compliance with documentation standards. Exceptions, "partial Releases," can occur with the agreement of the customers.

5.6 Transition Phase

NDE works with end-user organizations to coordinate preparations to integrate the NPOESS products into their operations. The preparations are based on the requirements collected during the Customer Coordination phases and the preparatory activities of the Test phases, during which trial versions of the products were used to prototype enhanced end user operations.

NDE transfers operations and maintenance (O&M) responsibility for product generation and distribution to OSDPD at the Transition Phase. OSDPD will operate and perform essential maintenance to the systems within the context of its Environmental Satellite-data Processing Center (ESPC). ESPC will continue a close relationship to NDE by making system performance metrics and customer service metrics available during subsequent Customer Coordination phases to assist with project planning.

The instrument payload of each satellite influences the NDE schedule of product development. Early in the NPOESS Program, the NDE schedule will reflect the fact that some EDRs are the product of more than one instrument; NDE's system development activities for such products will begin when xDRs from one satellite are received but will not be fully completed until after a successor satellite provides additional data from another instrument.

There will be many more data product introductions from NPP and NPOESS than has been typical of past satellites. Implementation of all of these products within two years of

introduction will require increases in NOAA's product research and development capacities commensurate with the increased number of products. Alternatively, NOAA will prioritize the products in order to develop generation capabilities that support the most important mission needs. Product development priorities will be based on benefits and user readiness to use the data.

6. PROJECT SCHEDULE [5]

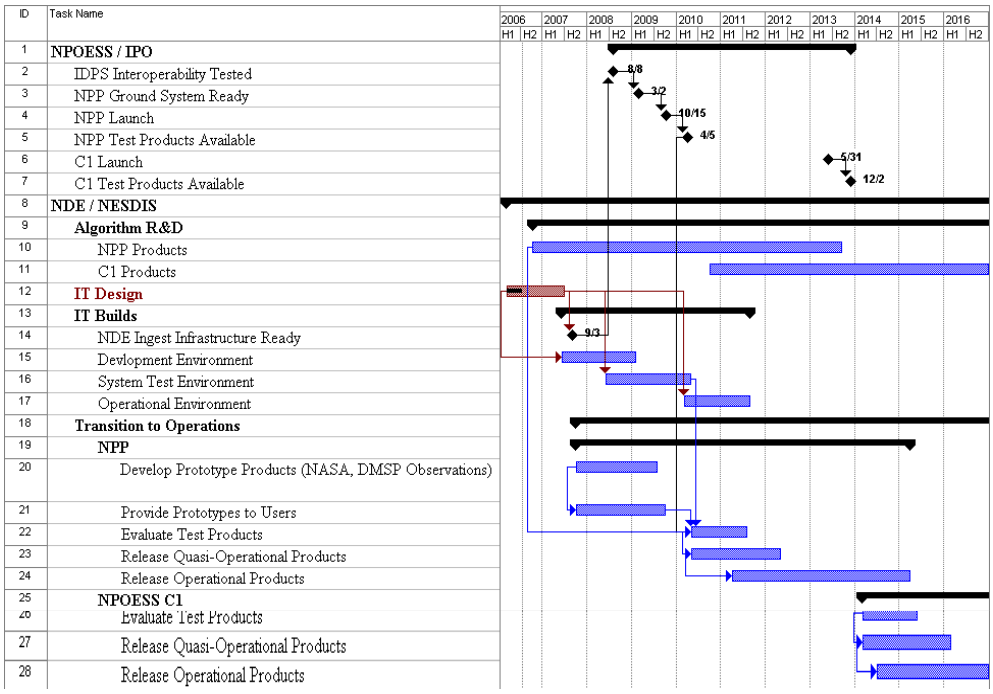


Figure 7: NDE Project Overview

6.1 NPP and NPOESS Launch Schedule

The NPOESS satellite launch schedule provides the NDE project with its fundamental planning structure. Each launch will be followed by a qualification period of on-orbit testing that might last as long as six months. Once certified as operational, each satellite is expected to continue service for about 5 ½ years.

The first satellite in the program will be unique in that it will not be certified as operational. The purpose of the first satellite is to mitigate the risks presented by all of the new technologies that will be implemented for NPOESS, not to provide operational products. In 2009, the risk-reduction NPOESS Preparatory Project (NPP) satellite will be launched. NDE will use products from the NPP satellite to develop product prototypes, a distribution network, and the core of its product packaging systems.

[5] NDE schedules in this section have been adjusted to reflect the NPOESS program schedule adjustments mandated by the Nunn-McCurdy analysis completed in June, 2006.

Table 1: Satellite Launch Schedule

Satellite	Planned Launch
NPP	Oct 2009
NPOESS C1	2013
NPOESS C2	2016
NPOESS C3	2018
NPOESS C4	2020

6.2 Payload Considerations

The NPOESS space segment consists of a new suite of instruments. As a result of the Nunn-McCurdy analysis, to reduce costs, some of the NPOESS instruments will be built with fewer capabilities than had been originally planned. Other sensors fall into a Government Furnished Equipment (GFE) category (i.e., if a user wants the sensor to fly, they have to provide funding for the sensor). In the list below, such a reduced capability is described in *[brackets]*.

- Visible-Infrared Imager Radiometer Suite (VIIRS)
- Cross-Track Infrared Sounder (CrIS)
- Advanced Technology Microwave Sounder (ATMS)
- Conical Microwave Imager Sounder *[Initial deployment on C2 rather than C1 and the original contract will be recompeted.]*
- Ozone Mapping and Profiling Suite (OMPS) *[Limb profiler is considered a GFE capability. The redesigned version will collect profile data from the nadir only]*
- Space Environment Monitor (SEM) *[Reduction in the number of sensors. Reintroduction of the dropped sensors is being analyzed for later satellites.]*
- Advanced Data Collection System (ADCS)
- Search And Rescue Satellite Aided Tracking (SARSAT)
- CERES (C1 only)

Government Furnished Equipment sensors that are waiting user funding include:

- OMPS Limb Profiler
- Earth Radiation Budget Sensor (ERBS)
- Aerosol Polarimetry Sensor (APS)
- Altimeter (Alt)
- Survivability Sensor (SS)
- SESS

The actual sensor complement for a particular orbit will be selected to provide optimum satisfaction of the system requirements. Current plans, which are subject to change, call for the following deployments.

Table 2: Instrument-to-Satellite Cross Reference

SATELLITE	NPP	C1	C2	C3	C4
LAUNCH	Oct 2009	2013	2016	2019	tbd
NODAL TIME	1330	1330	530	1330	530
* VIIRS	X	X	X	X	X
* Conical M/W Imager/Sounder			X	X	X
* CrIS	X	X		X	
* ATMS	X	X		X	
OMPS Nadir	X	X		X	
SEM		X		X	
SARSAT		X	X	X	X
ADCS		X		X	
CERES		X			
TBD (Satellite to be assigned)					
OMPS Limb					
ERBS					
ALT					
SESS					
TSIS					
APS					
SUS					

An * indicates a mission-critical instrument: Replacement will be provided within 6 months in case of failure.

A characteristic of the spiral development approach is that additional Build Cycles can be initiated at any time during the execution of the Project. The need to plan another Build Cycle is most likely to become apparent during a Customer Coordination Phase, as the scope of a Release is being analyzed. However, if the need for a new Build Cycle becomes apparent at any point, NDE's Project Manager will initiate a Customer Coordination Phase and use its framework to fully develop a plan for a new Build Cycle.

External events can also trigger new Build Cycles. If necessary, NESDIS will respond to changes in satellite payload, changes to satellite launch schedules, accelerations in technological advancement, changes in government priorities, changes to related projects, and so on. When appropriate, in response to such changing circumstances, additional Build Cycles will be planned.

NDE Build Cycles will have as their highest priority the routing of NPOESS data records, as received from the IDPS, directly to customers. Tailoring and NOAA-unique product generation will have lower priority and will be provided based on agreements reached during each Customer Coordination Phase.

Table 3 shows product introductions based on two categories, “core products” and “other products.” Core products are those NESDIS currently provides from POES, DMSP, and EOS satellites. Other products are those that do not replace current products and/or will be developed from instruments with which NESDIS has little or no experience. NDE, in order to support the continuity of its customers’ missions, places a higher priority on efforts required to deliver core products. If the instrument payloads change from the IPO’s current baseline, NDE will re-plan the product development activities appropriately.

The high rate of new data product introductions from NPP and NPOESS represents a significant change in the pace of product introductions from past satellites. Implementation of all of these products within two years of introduction will require increases in NOAA’s product research and development capacities commensurate with the increased number of products. Alternatively, NOAA will prioritize the products in order to develop generation capabilities that support the most important mission needs.

6.3 Life Cycle Scheduling

Figure 8 is a Gantt chart that depicts the three, highest level planning structures of the project.

1. A Product Prototype Build Cycle with one activity stream: Product Prototyping
2. An NPP Build Cycle with two activity streams: IT Development and Product Development
3. A C1 Build Cycle with two activity streams: IT Refresh & Redesign and Product Development

ID	Task Name	Start	Finish
1	Satellite Launch Schedule	Thu 10/1/09	Mon 10/1/18
2	NPP	Thu 10/1/09	Thu 10/1/09
3	NPOESS C1	Tue 10/1/13	Tue 10/1/13
4	NPOESS C2	Sat 10/1/16	Sat 10/1/16
5	NPOESS C3	Mon 10/1/18	Mon 10/1/18
6	NDE PROJECT	Wed 3/15/06	Fri 6/18/21
7	NPP PRODUCT PROTOTYPE CYCLE	Tue 8/1/06	Mon 8/2/10
8	CUSTOMER COORDINATION	Tue 8/1/06	Fri 8/1/08
10	DESIGN	Tue 8/1/06	Fri 8/1/08
13	CONSTRUCTION (product systems)	Tue 8/1/06	Fri 7/31/09
16	TEST	Wed 8/1/07	Mon 8/2/10
18	TRANSITION	Fri 8/1/08	Tue 9/1/09
21	NPP BUILD CYCLE	Wed 3/15/06	Fri 5/31/13
22	CUSTOMER COORDINATION	Fri 9/15/06	Wed 9/15/10
26	DESIGN	Wed 3/15/06	Wed 8/15/07
33	CONSTRUCTION	Thu 11/16/06	Mon 2/22/10
45	TEST	Thu 4/1/10	Fri 5/31/13
47	TRANSITION	Fri 7/15/11	Thu 7/12/12
50	C1 BUILD CYCLE	Thu 7/15/10	Mon 2/1/16
51	CUSTOMER COORDINATION	Thu 7/15/10	Thu 7/15/10
53	DESIGN	Fri 6/1/12	Wed 4/2/14
64	CONSTRUCTION	Thu 12/1/11	Wed 2/4/15
85	TEST	Wed 1/1/14	Tue 1/27/15
88	TRANSITION	Tue 4/1/14	Mon 2/1/16
92	C2 BUILD CYCLE	Fri 6/19/15	Wed 6/19/19
95	C3 BUILD CYCLE	Mon 4/3/17	Fri 6/18/21

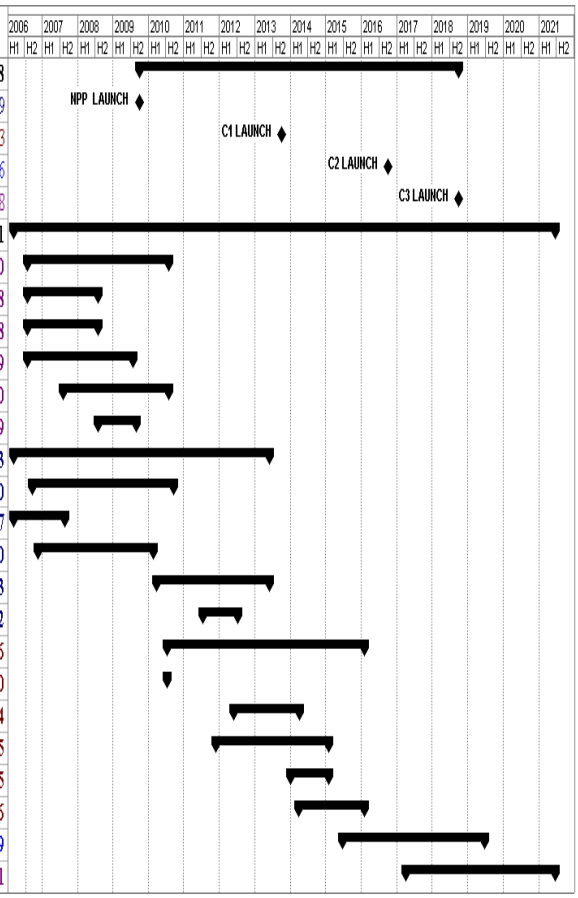


Figure 8: NDE Project Build Cycles

6.4 Prototyping Build Cycle

ID	Task Name	Start	Finish
1	**NDE PROJECT**	**Tue 8/1/06**	**Mon 8/2/10**
2	**NPP PRODUCT PROTOTYPE (NASA & DMSP DATA) CYCLE**	**Tue 8/1/06**	**Mon 8/2/10**
3	**CUSTOMER COORDINATION**	**Tue 8/1/06**	**Fri 8/1/08**
4	Transition Planning	Tue 8/1/06	Fri 8/1/08
5	**DESIGN (prototyping with NASA & DMSP observations)**	**Tue 8/1/06**	**Fri 8/1/08**
6	Microwave Products	Tue 8/1/06	Fri 8/1/08
7	Image products	Tue 8/1/06	Fri 8/1/08
8	**CONSTRUCTION (product systems)**	**Tue 8/1/06**	**Fri 7/31/09**
9	Microwave products	Tue 8/1/06	Fri 7/31/09
10	Image products	Tue 8/1/06	Fri 7/31/09
11	**TEST**	**Wed 8/1/07**	**Mon 8/2/10**
12	Disseminate Prototype Products to Users	Wed 8/1/07	Mon 8/2/10
13	**TRANSITION**	**Fri 8/1/08**	**Tue 9/1/09**
14	Complete Initial Release of Prototype NPP Products	Fri 8/1/08	Fri 8/1/08
15	Complete Second Release of Prototype NPP Products	Mon 8/3/09	Tue 9/1/09

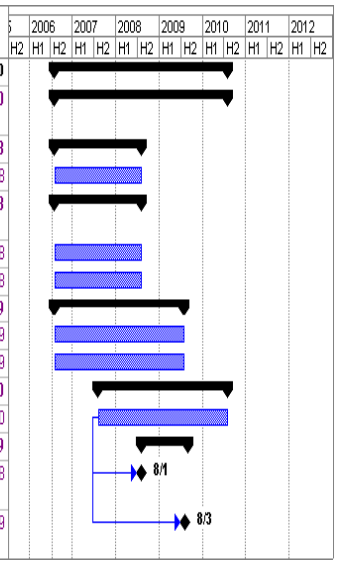


Figure 9: Prototyping Build Cycle

6.4.1 Product Prototyping Prior to NPP

Current NOAA POES, MetOP, NASA and DMSP satellites are providing microwave observations that are similar in many respects to those that will be available from the ATMS on the NPP and NPOESS satellites.

- POES/MetOP – Advanced Microwave Sounder (AMSU)
- DMSP - Special Sensor Microwave Imager/Sounder (SSMIS)
- NASA/IPO/DOD – WINDSAT is a risk reduction demonstration project that uses a multifrequency polarimetric microwave radiometer

NDE is supporting the development of the Microwave Integrated Retrieval System (MIRS) which can generate a suite of products using observations from these instruments. There are thirteen separate products in the suite and offer STAR the opportunity to prototype some of the most important products required from NPP and NPOESS. These include:

- Total Precipitable Water
- Cloud Liquid Water
- Ice water Path
- Precipitation Type/Rate
- Hydrology Profile
- Temperature Profile
- Moisture Profile
- Snow Cover
- Snow Water Equivalent
- Sea-Ice
- Land Surface Temperature
- Land Surface Emissivity

- Temperature/Moisture Profiles

6.4.2 Prototyping Phases

Customer Coordination Phase
These activities will result in plans for the trials of the MIRS prototypes in the NCEP and other user test systems.

Design Phase
As prototypes are developed during the parallel Construction Phase (below), the MIRS developers will document the algorithms required for operational product generation. These specifications will then be provided as input to the product designers during the NPP Build Cycle. The specifications will detail not only algorithm structure, but performance characteristics, test plans at the Unit, String and Systems Test Levels, and will be compliant with the NDE/ESPC Configuration Management requirements (tbd, being developed during the parallel NPP Build Cycle).

Construction Phase
Using observations available from current satellites, MIRS scientists will use rapid prototyping techniques to generate sample products that can be provided to customers and ESPC developers for analysis of impact on their systems.

Test Phase
MIRS will document the test findings of NCEP and other users and ESPC operators and developers. Algorithm specifications will be refined. ESPC test plans including test scripts and test data sets, particularly for System-level Performance Tests and System-level Regression Tests, will be developed. In turn, these will be used as prototypes to help specify the characteristics of the System Test Environment being implemented during the Construction Phase of the NPP Build Cycle.

Transition Phase
The MIRS prototype product development transitions NPP like products from three DMSP satellites, all of which will go through a transition phase. The prototype products will transition into operations in April 2008, March 2008 and July 2009.

6.5 NPP Build Cycle

ID	Task Name	Start	Finish
1	**Satellite Launch Schedule**	**Thu 10/1/09**	**Thu 10/1/09**
2	NPP	Thu 10/1/09	Thu 10/1/09
3	**NDE PROJECT**	**Wed 3/15/06**	**Fri 5/31/13**
4	**NPP PRODUCT PROTOTYPE CYCLE**	**Tue 8/1/06**	**Mon 8/2/10**
18	**NPP BUILD CYCLE**	**Wed 3/15/06**	**Fri 5/31/13**
19	**CUSTOMER COORDINATION**	**Fri 9/15/06**	**Wed 9/15/10**
20	1st NPP Product Requirements Workshop	Fri 9/15/06	Fri 9/15/06
21	2nd NPP Product Requirements Workshop	Mon 9/17/07	Mon 9/17/07
22	NPP Product Development Acquisitions Finalized	Wed 9/15/10	Wed 9/15/10
23	**DESIGN**	**Wed 3/15/06**	**Wed 8/15/07**
24	**Enterprise Architecture**	**Wed 3/15/06**	**Wed 8/15/07**
25	Develop Preliminary Design	Wed 3/15/06	Mon 9/4/06
26	Preliminary Design Review (PDR)	**Tue 9/5/06**	**Tue 9/5/06**
27	Delta PDR	Wed 11/15/06	Wed 11/15/06
28	Develop Critical Design	Thu 11/16/06	Wed 8/1/07
29	Critical Design Review (CDR)	**Wed 8/15/07**	**Wed 8/15/07**
30	**CONSTRUCTION**	**Thu 11/16/06**	**Mon 2/22/10**
31	**Enterprise Tools**	**Thu 11/16/06**	**Fri 5/29/09**
32	**Build the Development Environment**	**Thu 11/16/06**	**Wed 1/30/08**
33	Acquire & Build the Development Env't	Thu 11/16/06	Mon 12/10/07
34	Complet Acceptance Test (Dev't Env't)	Wed 1/30/08	Wed 1/30/08
35	**Build the System Test Environment**	**Mon 10/1/07**	**Fri 5/29/09**
36	Acquire & Develop the System Test Env't	Mon 10/1/07	Thu 4/30/09
37	Complete Acceptance Test (Syst Test Env't)	Fri 5/1/09	Fri 5/1/09
38	Complete Interoperability Testing with NPOESS Ground System	Fri 5/29/09	Fri 5/29/09
39	**Enterprise System Readiness Review**	**Mon 2/22/10**	**Mon 2/22/10**
40	**Products**	**Tue 4/17/07**	**Mon 2/15/10**
41	Develop Core NPP Products (VIIRS, CrIS, OMPS, ATMS)	Tue 4/17/07	Mon 2/15/10
42	**TEST**	**Thu 4/1/10**	**Fri 5/31/13**
43	Disseminate Core Products to Users	Thu 4/1/10	Fri 5/31/13
44	**TRANSITION**	**Fri 7/15/11**	**Thu 7/12/12**
45	Complete Initial Release of NPP Products	Fri 7/15/11	Fri 7/15/11
46	Complete Second Release of NPP Products	Tue 6/12/12	Thu 7/12/12

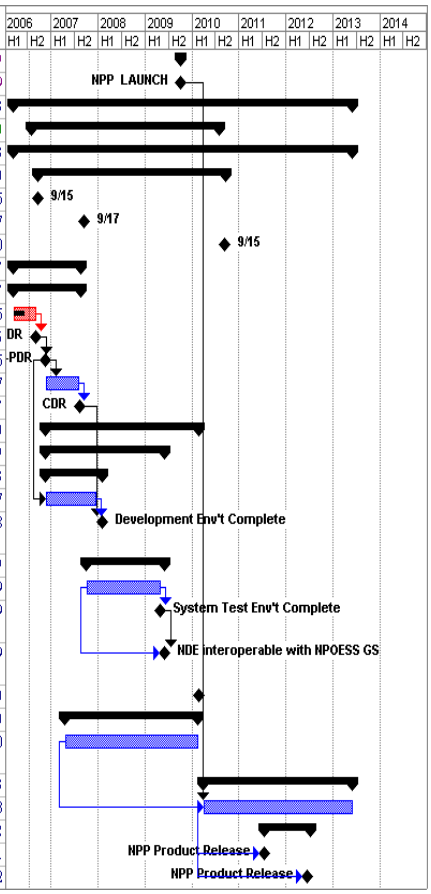


Figure 10: NPP Build Cycle

6.5.1 Systems Development

A significant proportion of the effort to be expended during the NPP Build Cycle will be devoted to establishing new data processing capabilities in NESDIS. Although the primary objective is to prepare the infrastructure for NPP, the work is being undertaken with a broader, enterprise perspective such that the capabilities established will be, to the greatest extent possible, reusable by other polar and geostationary satellite systems.

The NPP Build Cycle is the framework for the design, construction and testing of the NDE System as a whole, conceived as three similar, but distinct, environments: Development, System Test, and Operations.

A. A shared **Development Environment** will be established for use by Product Development teams and by the ESPC Data Processing development teams. This environment provides developers with the common (e.g., enterprise) toolset, access to historical data to assist with testing, and sufficient capacity to run retrospective tests for the purposes of comparing new capabilities with historical product generation. By sharing standard development elements

between the developers of ESPC's data processing systems and the Product Development teams, NDE expects to address some of the technical challenges that have historically caused delays in the transition of research product systems to operations.

The reusable software (e.g., "enterprise tools") of the ESPC Data Processing systems will be developed within this Build Cycle. For the NPP era, a scaled-down version of the specified infrastructure, with sufficient capacity to handle the NPP xDRs, will be acquired, installed and tested (Figure 10, row 13). However, a System Test environment, similar to Operations, will be established during the NPP Build Cycle.

B. During the NPP Build Cycle a **System Test environment** will serve as a risk-reduction capability to work out the volume, performance, and throughput issues that will challenge NESDIS after NPP. The System Test environment will serve a dual purpose during NPP: providing system resources needed for the quasi-operational generation and delivery of products and providing configuration control, quality control, and a test bed to determine whether candidate NDE system components:

- Are complete (configuration management)
- Can function in the operational environment (i.e., stress tests, regression tests, interoperability tests, etc.)
- Conform to NESDIS standards

ESPC's operators of the System Test Environment will assist the developers of both NDE's reusable Data Processing and distribution capabilities (e.g., "enterprise tools") and Product Processing Applications. Accordingly, they will advise developers of the configuration management and system testing standards with which they must comply. Developers, of both Product Processing Applications and of Enterprise Tools, will assist the staff of the System Test environment to run tests to fully simulate operational conditions for new or enhanced product processing applications, as well as compliance to configuration management standards.

C. Operational Environment – During the Design Phase, an NDE Operations Plan will be developed describing NDE's normal operations, security, system controls, emergency backup, error handling, Configuration Management (including transition of algorithms from development to operations), Continuity of Operations Plan (COOP), and the specifications for Operator Handbooks. During the Design Phase of this Cycle, a decision will be made regarding both long-term and emergency backup capabilities. Traditionally, NESDIS' Test resources have provided continuity when operational systems fail. During NPOESS, however, there are additional alternatives including the other Centrals and a new critical backup infrastructure at NESDIS' Wallops facility that is being designed in the context of the Critical Infrastructure Plan (CIP).

Interfaces with the IDPS and other NPOESS segments will be installed, tested, and certified during the NPP Build. The Systems Development Team is responsible for validating and verifying all interfaces between the NPOESS ground system and NDE according to specification.

High-speed telecommunications and customer distribution networks will be designed and established during the NPP Build.

During the NPP Build Cycle, the telecommunications links to CLASS and customers will be established. The NDE Project and the CLASS Program will cooperate in the following manner. It will be the responsibility of the CLASS project to implement the capabilities that will ensure that all NOAA-unique products from NDE are archived and accessible over the long-term. It will be the responsibility of the NDE project to provide the resources required to implement these capabilities in the CLASS system. Eighteen months after the last of the three initial NPOESS

satellites is declared operational, CLASS will assume full responsibility for all NDE long-term archive capabilities.

6.5.2 Product Development

The Customer Coordination Phase focuses on ensuring that user requirements are understood and that product priorities are based on a realistic assessment of NOAA's needs. The phase is executed in concert with the parallel NPP Prototype Cycle which will provide information regarding the science and systems factors that will need to be understood by users as they refine their product requirements and priorities. These findings (based on algorithms developed for microwave product prototypes from existing sensors) will also inform the developers of NPP products who will start their research on products with simulated data sets early in the Cycle (row 40, above).

Customer Coordination in this Build Cycle is the longest and most labor intensive of the three currently planned cycles. The intention is to use this Build Cycle to understand how products developed for NPP can best be leveraged for the era when the NPOESS operational satellites replace the POES satellites, beginning in 2013. Three milestones will focus customers' attention on the requirements and prioritization issues: the first and second requirements workshops (2006 and 2007), and finalization of NPP product acquisition targets in September 2010.

Users will have an opportunity to work with NPP products as soon as they are made available (row 43). NDE anticipates that some of these trials will result in requests by the users for NESDIS to disseminate them on a more reliable and predictable basis. The Product Release milestones of the Transition Phase will focus both users and NESDIS management on the work necessary to accomplish this.

6.5.3 Concluding the Cycle

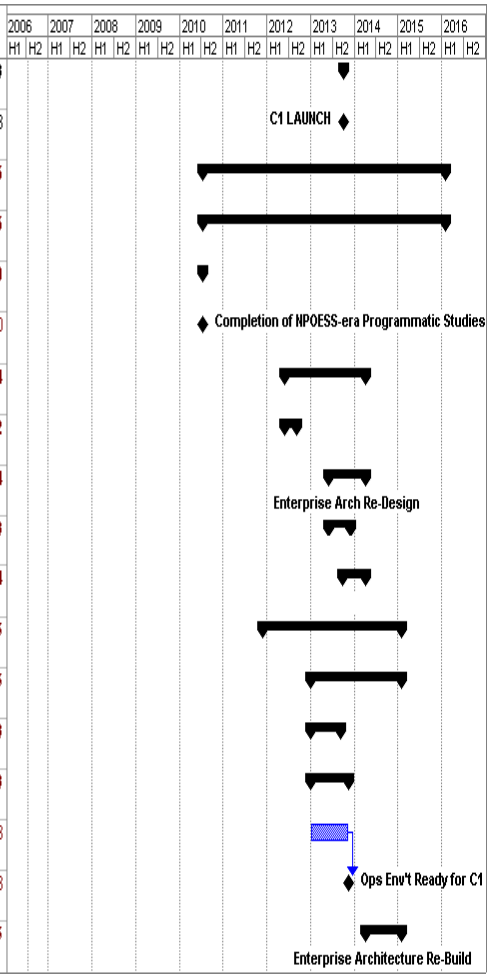
The primary factor that will determine whether to conclude this, or any, Build Cycle will be the extent to which the products promised have been delivered according to the user acceptance criteria agreed at the conclusion of the Design Phase.

From a Project Management perspective, the conclusion of each Phase within each Build Cycle will offer opportunities to refine the project approach and to update the Integrated Project Plan. The spiral methodology and Work Breakdown Structure (WBS) will be re-evaluated and altered based on lessons learned. At the conclusion of each Build, after the Release, the management procedures for planning, controlling, and executing the project are to be refined if necessary.

6.6 C1 Build Cycle

Figure 11: C1 Build Cycle

ID	Task Name	Start	Finish
1	**Satellite Launch Schedule**	**Tue 10/1/13**	**Tue 10/1/13**
2	NPOESS C1	Tue 10/1/13	Tue 10/1/13
3	**NDE PROJECT**	**Thu 7/15/10**	**Mon 2/1/16**
4	**C1 BUILD CYCLE**	**Thu 7/15/10**	**Mon 2/1/16**
5	**CUSTOMER COORDINATION**	**Thu 7/15/10**	**Thu 7/15/10**
6	Complete NPOESS-era Programmatic Studies	Thu 7/15/10	Thu 7/15/10
7	**DESIGN**	**Fri 6/1/12**	**Wed 4/2/14**
8	**Prep for Technology Refresh (TR)**	**Fri 6/1/12**	**Mon 9/3/12**
11	**Re-Design Enterprise Architecture**	**Mon 6/3/13**	**Wed 4/2/14**
12	**Design Dev't Env't Upgrades**	**Mon 6/3/13**	**Fri 11/29/13**
15	**Design System Test and Ops Upgrades**	**Mon 9/23/13**	**Wed 4/2/14**
18	**CONSTRUCTION**	**Thu 12/1/11**	**Wed 2/4/15**
19	**IT CONSTRUCTION**	**Tue 1/1/13**	**Wed 2/4/15**
20	**Technology Refresh**	**Tue 1/1/13**	**Wed 9/11/13**
23	**Establish C1 Operational Environment**	**Tue 1/1/13**	**Thu 11/14/13**
24	Develop/Aquire Operational Env't	Tue 1/1/13	Fri 11/8/13
25	System Acceptance Test (Oper'l Env't)	Thu 11/14/13	Thu 11/14/13
26	**Construct Enterprise Architecture Enhancements**	**Thu 4/3/14**	**Wed 2/4/15**



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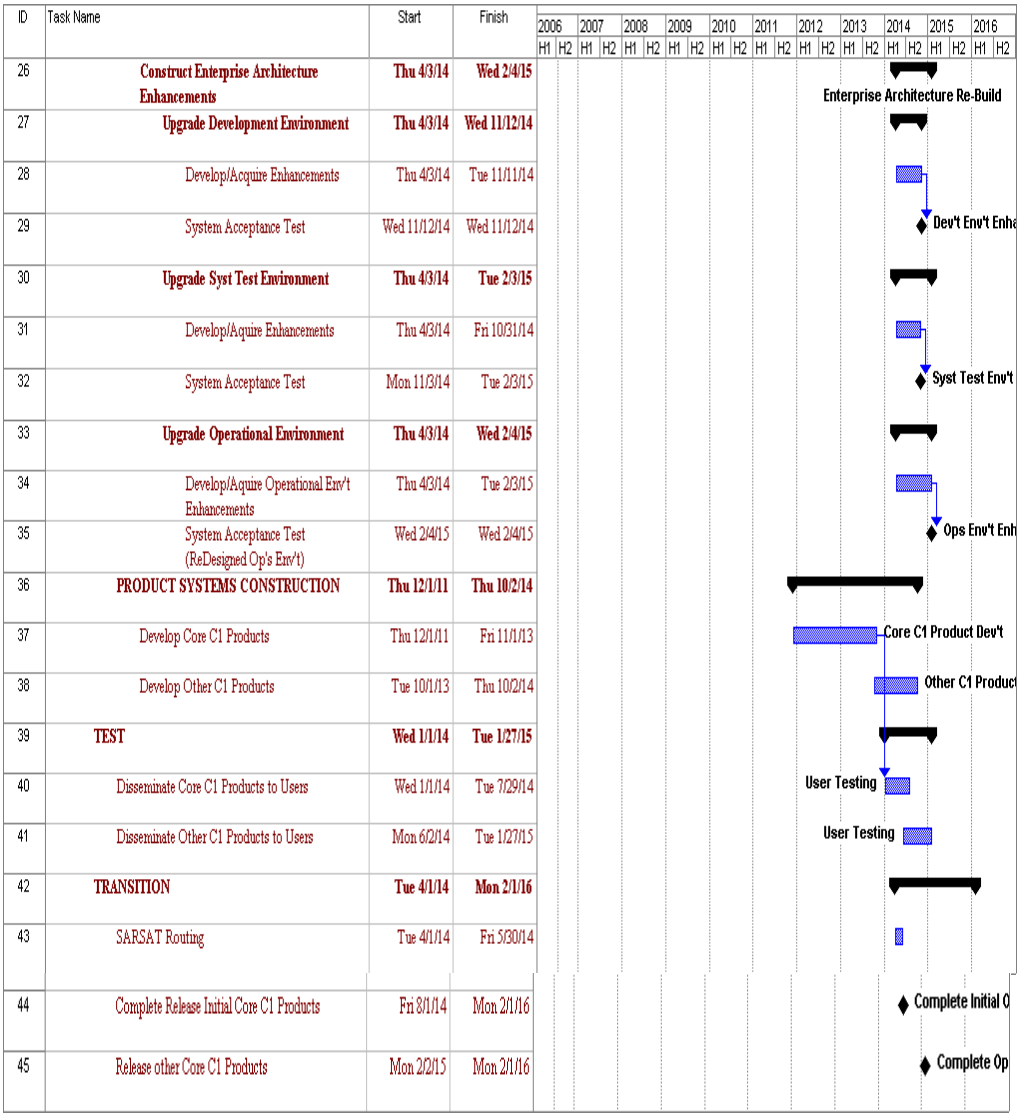


Figure 11: C1 Build Cycle

6.6.1 Systems Development

The prior Build Cycle, NPP's, saw the establishment of a dual purpose satellite data processing capability, called the NDE System Test Environment. During NPP, System Test will have provided quasi-operational conditions so that ESPC and STAR developers will have a robust, configuration-controlled environment in which their software can be tested. System Test will also provide the infrastructure for the regular operations necessary to receive NPP data from the IDPS, generate the NDE value-added products, and disseminate them to customers. This is in keeping with NPP's risk reduction mission. The C1 Build Cycle, in contrast, is designed to establish *operational* capabilities that take advantage of the lessons learned during NPP. It is anticipated

that much of the infrastructure called System Test during NPP, will be renamed and its capabilities extended as the C1 Operational Environment (Figure 11, Rows 23-25).

Several years will have elapsed since the NDE/ESPC System was designed. Anticipating the rapid pace of technological advancement, the C1 Build Cycle dedicates effort to both refreshing the technologies implemented in prior years (Figure 11, Rows 8, 20) and the probability that some fundamental design assumptions will have to be reconsidered to take advantage of new technologies that are likely to have become available during the intervening period (Figure 11, Rows 7-17, 26-35).

During the Customer Coordination Phase, Project Management and Customers conduct detailed analyses of the Customer Service metrics logged during the course of the project. For example, knowledge of how many problems were reported for particular products is likely to influence the Product Development priorities. Knowledge of which customers submit trouble tickets will influence planning for Customer Coordination activities. Trend analyses of Service Requests could indicate changes in customer capabilities related to such factors as volume increases or timeliness of product delivery. In short, the analysis of metrics associated with Customer Service (trouble tickets, service requests, ordering patterns, and the like) will provide NDE Project Management with powerful indicators to guide future Project Planning.

6.6.2 Product Development

Many of the products to be developed during this Build will extend the product applications begun on the VIIRS-only versions of products developed during the NPP Build.

Upgrades to NESDIS and customer systems will be specified during Design and implemented during the Construction Phase.

Customer hardware, software, and human resources will be upgraded based on the cooperative analysis of their systems conducted during the Programmatic Studies of Customer Coordination phase.

During the Test Phase, user systems begin to exploit C1 products on a simulated operational basis. The core product prototypes will be made available to test in customer environments.

NDE will work closely with customers during Transition (Figure 11, rows 42-45), providing sufficient Customer Service resources to support all customer transition activities including provision of product training. Some of the VIIRS-derived products will be introduced as the C1 Release of core products. The other VIIRS-derived products (those not essential to continue current POES, DMSP, or EOS missions) will be part of a second release (row 45) along with new products from the Space Environment Monitor (SEM).

6.6.3 Concluding the Cycle

From a Project Management perspective, the conclusion of this Build Cycle will be an opportunity to refine the project approach and to update the Integrated Project Plan. The spiral methodology and work breakdown structure (WBS) will be re-evaluated and altered based on lessons learned. After the C1b Release of non-core products, the management procedures for planning, controlling, and executing the project are to be refined if necessary.

6.7 Out-Year Build Cycles

The C2 satellite's payload may include the microwave instruments necessary to complete the NPOESS on-orbit design. The C3 launch is tentatively scheduled for 2018. However, the C2 and C3 dates are well beyond the 5 year budget horizon of current NOAA budget procedures (see Section 5.1).

Through the year 2020, the NDE project will continue as NESDIS' means for planning and executing activities necessary to assist NOAA and other civilian users to realize the full potential of NPOESS. Beyond 2020, other means may be available.

7 ACQUISITION STRATEGY

The project will budget for three categories of effort: Product Development, Systems Development, and Transition. (Project Organization Chart)

7.1 Product Development

A recent survey of NOAA users identified preliminary requirements for over fifty NOAA-unique products. The same survey identified over 150 product tailoring tasks. These tentative product requirements are based on only a preliminary understanding of NPOESS' potential. Years of investigation and experimentation are anticipated in order for the full potential of the sensor data to be exploited. As these understandings are achieved, the requirement for NPOESS products is expected to grow significantly. The NDE project must focus and direct scientific and engineering tasks in order to satisfy the needs of the NOAA user community and other customers of NPP and NPOESS sensor products.

The key element of NDE's acquisition strategy, therefore, is the establishment of centralized procedures for the analysis, prioritization, selection, and funding of NPOESS product development tasks. A year prior to each execution year, the NDE project manager will evaluate and prioritize new product capabilities required based on the results of the most recently completed Customer Coordination phase. The NDE project manager will issue a request for product development proposals related to the prioritized needs. The proposals will be reviewed by an NDE Management Board at the NDE Annual Procurement Review. Following the annual review the NDE project manager will determine the funding allocation recommendation. The Polar Program Manager will then issue the funding allocation memo for projects to be funded in the next fiscal year. All projects to be funded will develop a project plan briefing. All contract or grant packages will be reviewed by OSD before funds can be committed.

Continuation funding for projects will be reviewed at the annual review process described above. Tasks spanning multiple years will demonstrate achievement of planned, tangible milestones in order to receive continued funding.

15 percent of any year's PD budget will be set aside for *ad hoc* requests to fund unanticipated, urgent tasks.

Much prioritization was accomplished during the period of time that user requirements were captured by the IPO for the IORD. Certain EDRs have been designated as Key Performance Parameters (KPPs). Products in this category have been identified by the user community in the IORD as the most important deliverables from the NPP/NPOESS program.

- Atmospheric Vertical Moisture Profile
- Atmospheric Vertical Temperature Profile
- Imagery
- Sea Surface Temperature
- Sea Surface Winds
- Soil Moisture

Another prioritization factor has to do with continuing the POES mission. The final satellite in that program, N', like NPP, is scheduled for 2009 launch. If it should fail, there must be a backup in orbit to continue supplying operational products to NOAA. A MetOp

satellite, the European component of the POES constellation, because it is already a POES satellite, will be the primary backup. Although not officially designated as the N' backup, NPP will be in a position to provide observations if needed.

Table 4 shows a hypothetical set of product introductions for FY10, FY11, and FY12. Most will provide continuity for current NOAA missions. It is important to note that NDE's current budget for NPP (FY07 – FY11) is insufficient for total N-Prime backup. Instead, the budget is based on the assumptions that *a)* All N-Prime instruments will function at 100% capability from 2010 through 2014 and *b)* that NPP's sole purpose is to provide risk reduction opportunities in preparation for NPOESS C1 in October of 2013. These assumptions constrain the funding for product development during the NPP Build Cycle.

Table 4: NPP Products

	FY10	**FY11**	**FY12**	Totals	Developmental Product Not Considered POES Operational Continuity
Tailored Products	**9**	**8**		**17**	**4**
	ATMS Radiances	Vegetation Index			Aerosol Particle Size
	VIIRS Radiances	Active Fires			Cloud Top Temp
	OMPS Radiances	Atmos Temp Profile			Cloud Top Pressure
	Cloud Mask	Aerosol Optical Thickness			Land Surface Temp (VIIRS)
	Sea Surface Temperature (SST)	Surface Type & Vegetation Cover			
	Ozone Profile	Surface Albedo			
	Snow Cover	Cloud Cover Layers			
	Imagery				
	* *Ocean Color*				
NOAA-Unique Products	**10**	**10**	**6**	**26**	**10**
	CrIS Radiances	Blended Snow Cover	Blended Ozone		Cloud Cleared Radiances (CrIS)
	Total Precipitable Water	* *Harmful Algal Blooms*	VIIRS Cloud Drift Winds		Clear Sky Radiances (VIIRS)
	Snow Cover (ATMS)	Blended SST	Outgoing Long-Wave Radiation (VIIRS)		Vegetation Health
	Precipitation Rate	SST Anomalies	Outgoing Long-Wave Radiation (CrIS)		Vegetation Moisture

	Surf Emissivity	Coral Reef Deg Heating	Absorbed Radiation		Drought Indices
	Cloud Liquid Water	Coral Reef Bleaching	Rainfall		Vegetation Thermal Conditions
	Sea Ice Concentration	Tropical Rainfall Potential			Leaf Area Index
	Snow Water Equivalent	Vegetation Fraction			Fire Potential
	Ice Water Path	Hazard Support (Tropical)			SST (AVHRR-like)
	Land Surface Temp	Hazard Support (Volcano)			Aerosol (AVHRR-like)

* *NASA EOS observation used by NOAA operational centers*

Based on the budgets available, Table 5 shows the number of products that can actually be provided to users during the NPP Build Cycle to help them prepare for the transition to NPOESS in 2013. The NDE project manager, along with an Executive Board, will decide which of the products (Table 4, above) will be developed.

Table 5: Number of Budgeted NPP Product Introductions

	FY10	FY11	FY12	Tot
Tailored Products	**6**	**9**	**6**	**21**
NOAA-Unique Products	**0**	**2**	**6**	**8**

7.2 System Development

The NDE System Development Manager will fund a team of software developers to identify and deliver shared data processing capabilities. These capabilities are necessary in order to reduce the risks associated with developing and operating many product generation applications in a single environment. NOAA simply cannot afford to treat each NPOESS product generation system as a unique challenge. Rather, NDE seeks to establish a common tool set that will allow the scientific product development teams to focus on the science, using functionality available to all of them to perform the more mundane data processing tasks.

These capabilities will operate within NESDIS' ESPC. NDE will cooperate closely with ESPC Management. ESPC, with NDE funding, will use its contract vehicles to procure the technologies that enable both the development and the operation of the enterprise capabilities. In this relationship, the NDE System Architect provides the requirements for technologies such as:

- Relational Data Base Management System (RDBMS)
- Object Repositories
- Fourth Generation Languages
- Test Tools

- Configuration Management Systems
- Work Management Tools Schedulers
- Help Desk Software
- Reporting tools
- Process/Project Management tools
- Etc.

As the initial, primary users of these technologies, the ESPC's NDE System Development Team will assist ESPC operations staff to configure, install, and test the products in the appropriate environments.

7.3 Infrastructure Acquisition, Operations, and Maintenance

The OSDPD capability that will address the technological challenges of both NPOESS and the next generation of geostationary satellites is called the Environmental Satellite-data Processing Center (ESPC). The NDE environments within NESDIS for which ESPC must acquire hardware and associated software include:

- Algorithm development/test
- Enterprise tool development/test
- System test (also serving as backup for normal operations in emergencies)
- Normal operations
- Distribution networks and telecommunications
- Disaster recovery

The NDE Architect will be responsible for providing requirements and specifications for all of the technologies needed for these environments. The NDE Project Manager will direct funds to OSDPD for these purposes.

Most of this equipment will be installed and managed by ESPC at the National Satellite Operations Facility (NSOF) in Suitland, Maryland. Depending on decisions to be made in the context of NDE's System Architecture, as well as ESPC's design efforts with regard to shared data processing and collabSTARtive environments, some development equipment may be installed at remote sites. ESPC will provide authorized developers with high speed access to NSOF development resources (test databases, CM tools, documentation libraries, procedure libraries, etc.).

ESPC is responsible for the security of NDE's Operational, System Test, and Development capabilities. ESPC will establish and enforce security procedures to ensure the data integrity of all operational and developmental applications that run under its auspices, including NDE's. ESPC provides protection from access to NDE's automated resources by unauthorized users. ESPC will withhold specified NPOESS datasets from unauthorized users when so ordered by the Secretary of Commerce (e.g., data denial). Aside from these data denial requirements (TBD), NDE has no security requirements different from those ESPC will provide for all of the applications that operate under its auspices.

ESPC will provide maintenance and support for a selected Database Management System (DBS) as well as of the data content to be established on that system. NDE is committed to sharing this essential resource with all of NOAA. The NDE System Architect will coordinate the creation of data models by the various development organizations (CLASS, STAR, ESPC, NCDC, NGDC, NDE product developers, etc.). The Architect's coordination activities will focus on the identification of as many opportunities to share and reuse the maximum number of data entities and/or object classes. This coordination of conceptual data models is the

foundation of NDE's "enterprise approach." In turn, ESPC's database administrators (DBAs) will be responsible for maintaining the integrity of the operational forms of the models – the data itself.

ESPC will develop an ability to recover from disruptions of NDE product deliveries and services resulting from disasters. NDE has no disaster recovery requirements different from those ESPC will provide for all of the applications that operate under its auspices.

ESPC will provide customer services including:

- Product order tracking
- Management of trouble reports (logging and appropriate follow-up)
- Routing of customer product inquiries to qualified specialists

At the present time, NDE has no customer service requirements different from those ESPC will provide for all of the applications that operate under its auspices. However, NDE may levy the following customer service requirements on ESPC if requested during Customer Coordination Phases of NDE Build Cycles:

- Product order placement
- Service request management such as:
  - Capturing enhancement requests
  - Managing the resolution process for determining whether to undertake an enhancement
  - Conducting customer satisfaction surveys
  - Maintaining a database of customer requests to enable reporting by customer, by product, by request type, by status, and by date
- Management of online product training materials and other distance learning capabilities
- Extending operator working hours to provide customer assistance beyond eight hours on week days

ESPC will negotiate Service Level Agreements (SLA) with all of its product customers.

These agreements will guarantee levels of performance in terms of product deliveries, availability of access to system resources, and the availability of support from ESPC, either from operators or from automated Help applications. ESPC will establish similar agreements with selected NOAA offices chosen as representative of those who will use ESPC resources to develop products, including NDE's. At the present time, NDE anticipates no performance baselines different from those ESPC will provide for all of the applications that operate under its auspices.

The NPP satellite's products offer ESPC opportunities to prototype some of the high performance computing, high volume data management, and product distribution capabilities that will be required for ESPC. The first geostationary satellite to carry the new technologies, GOES R, is not scheduled for launch until 2014 - around the same time that C1 is expected to be operational. NDE, therefore, is the first project that will deliver the next generation of satellite products using ESPC capabilities.

Important aspects of the relationship between NDE and ESPC can be illustrated in terms of Configuration Management (CM) and System Testing. New or enhanced algorithms, for example, will be run in a System Test environment that simulates ESPC operations. In order for an algorithm to be certified as Operational, it must perform without causing errors (regression testing) or degrading performance (stress testing) when using the same configuration of enterprise resources (the DBMS, object repositories, shared procedures, etc.) as those running in the ESPC

operational environment. The algorithm will be submitted for System Testing as part of a package that might also include additional test data, enhanced versions of shared elements, documentation for new test procedures, and (in all cases) updated documentation for each of the enhanced components to be certified. New or enhanced enterprise tools will, likewise, be required to undergo the same level of system testing.

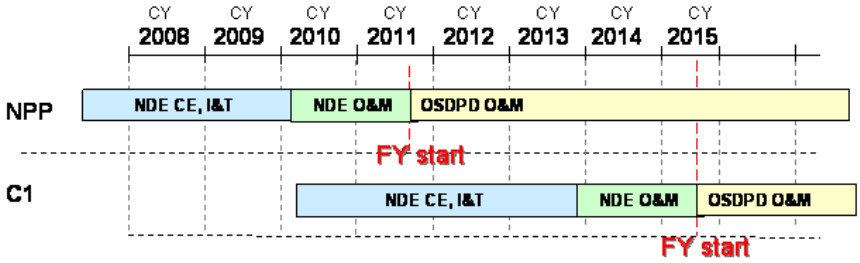


Figure 12: O&M Handover Schedule

ESPC will acquire and maintain the System Test environment. The human resources necessary to operate the System Test environment will also be ESPC's. However, the certification requirements to be implemented by the ESPC System Test personnel will be provided by the NDE System Architect. The ESPC System Test personnel will, in turn, be responsible for articulating the Operational and System Test standards and providing assistance to the development teams with their work to implement the standards within their applications. Initial funding for the staff needed to perform these development support roles will be provided by NDE. Eighteen months after the establishment of the System Test Environment, OSDPD will assume responsibility for funding the Operations and Maintenance (O&M) of the System Test environment.

NDE and OSDPD will share funding responsibilities for NDE-related technologies as illustrated by Figure 12. NDE's commitment begins 24 months prior to the launch of each of the 1st four satellites. Accordingly, NDE will provide funding for the capital expenses (CE) and the integration and testing (I&T) for all hardware, COTS, and telecommunications capabilities necessary to process the data from the satellite. Following a similar schedule, NDE will also provide funding for technologies needed to conduct development and testing for the products provided by the satellites. NDE will fund operations and maintenance (O&M) for all of these categories of technology for eighteen months after the launch of each satellite. OSDPD will assume funding responsibilities for O&M when NDE's eighteen month commitment is completed. OSDPD senior management will be the owner/lessor of record for all NDE-related technology acquisitions.

8 PROJECT PROCESSES

The NDE Project functions in relationship to many other organizations in NESDIS and NOAA. A graphical representation of those relationships is provided as Appendix C.

8.1 Planning Processes

8.1.1 Five-Year Planning

Annually, NDE provides five-year budgetary information in support of NOAA's Project Planning, Budgeting, and Evaluation System (PPBES). The PPBES procedures are ongoing, with annual cycles. PPBES is a hierarchical system that successively discovers commonalities between projects to eliminate redundancy. The process is based on the notion that each project must support at least one of NOAA's mission Goals. Within each Goal, sets of projects are organized as Programs. The NDE project reports to PPBES within a Science and Technology Infusion (STI) program for the Goal Team that is responsible for serving society's needs for "Weather and Water" information. (As demonstrated in "Section 2.1: Project Mission, Goals, and Objectives" NDE supports all four of NOAA's mission goals. Its placement within Weather and Water is based on the fact that the NWS has historically been the primary consumer of environmental polar satellite data.). During July and August, NDE provides its plans to the STI Program Manager for an execution year 2 ½ years hence. (For a fiscal execution year beginning October 1, 2008, NDE provides planning data in July and August 2005.)

The PPBES's office of Program Planning and Integration (PPI) reviews all program plans for an execution year to discover shortfalls and to determine whether to fund critical needs with uncommitted resources. This takes place during the month of April. During May and June, final review and approval of procurement plans for the execution year and the years following takes place.

NDE also provides five-year plans within a format prescribed by the Office of Management and Budget (OMB) called the "OMB Exhibit 300." These documents are submitted by NOAA to the Department of Commerce (DOC). NDE's plans are currently part of the OMB 300 that OSD provides for budgeting Polar Ground Systems' equipment and projects.

This document, the NDE Integrated Program Plan (IPP), is also reviewed by the NESDIS Executive Board (NEB) during its Five-Year Planning efforts. Of particular interest to them is Section 7's Five-Year Spend Plan. NDE submits the IPP to the NEB for review in September.

8.1.2 Integrated Project Planning

This document is called the Project Plan. It reflects NDE management's intentions for deploying the resources needed to satisfy requirements. Of necessity, a project with the scope of NDE will require a variety of planning documents (Test Plans, Training Plans, Development Plans, etc.). For any Build Cycle, therefore, approval of the Project Plan at the conclusion of the Customer Coordination Phase is fundamental to achievement of the first checkpoint. NDE management will continuously maintain the currency of the Project Plan by monitoring the Product Development Teams and the NDE/ESPC System Development Team.

8.1.3 Transition Planning

To be inserted as a hyperlink to the "NDE Transition Plan" in accordance with NAO 216-105, "POLICY ON TRANSITION OF RESEARCH TO APPLICATION", 05/31/05

8.2 Initiating Processes

Certain start-up activities deal with setting up a Build Cycle to ensure that it can be effectively managed. Start-up activities include the following:

- Engagement of Stakeholders - mobilizes the core project leadership and ensures that major stakeholders are fully informed and aligned with the objectives, approach, and deliverables
- Confirmation of Project Management Processes - establishes the project management processes for the Build Cycle:
  - Stakeholder and Communications Management
  - Scope and Requirements Management
  - Deliverables and Configuration Management
  - Team Management
  - Risk and Issues Management
  - Work and Schedule Management
  - Vendor and Contract Management
- Project Infrastructure Establishment - ensures that the infrastructure required by each of the NDE teams for the Cycle is secured and available to support the work and schedule defined by the Integrated Project Plan.
- Establishment of the teams - mobilizes the government staff and contractors who will do the work of the Build Cycle.

8.3 Controlling Processes

8.3.1 Work and Schedule Management

The NDE Project Manager will require each of the Product Development Teams, and the NDE System Development Team provide and maintain a Work Schedule consisting of:

- A Task List organized hierarchically (e.g., Work Breakdown Structure [WBS])
- Estimated Effort and Cost for each task
- Resources, either by skill type or by person name, assigned to the tasks
- Start and end dates for each task
- Checkpoints (end dates of more important tasks)
- Alternative views of the schedule
  - Gantt
  - Critical Path (Dependencies)

The NDE Project Manager will require each of the Product Development Teams and the NDE/ESPC Team provide Status Reports on a predetermined schedule. The Product Development Teams will provide Status Reports once every four months. The NDE/ESPC Team will report status monthly.

Team Leaders will provide the Status Reports advising NDE Project Management of the likelihood of completing scheduled tasks on time. Status Reports will be exception-oriented, emphasizing anticipated schedule slippages. Team leaders will describe:

- Reasons for anticipated slippages (e.g., issues)

- NDE Project Management actions that might be taken to resolve the issues

If immediate management action is required, Team Leaders will contact NDE Project Management prior to their scheduled Status Reports.

NDE Project Management will maintain an Issues Log that includes the dates, descriptions, and status of the matters to be resolved. “Open” issues will be handled as aggressively as possible to change their status to “closed.”

NDE Project Management will maintain a summary level Work Schedule derived from the WBSs of the Product Development Teams and the NDE/ESPC Team. NDE Project Management will use the summary plan to report such measures as Earned Value and Tasks Completed to senior management.

8.3.2 Scope and Requirements Management

8.3.2.1 Satellite Products and Services Review Board (SPSRB)

The NDE project will participate in an established method for evaluating product decisions through the membership of its Product Development Manager in the NESDIS Satellite Products and Services Review Board (SPSRB). The SPSRB is responsible for providing the oversight and guidance necessary to effectively manage product life cycles; from development, transition, operations, enhancements and, ultimately, product decommissioning. Product Oversight Panels (POPs), consisting of research scientists and end users with specialized product expertise, advise the SPSRB on matters relating to product prioritization, fitness of products for escalation to operational status, and the risks associated with development. SPSRB is responsible for determining how best to use NPOESS observations to continue critical NOAA missions, particularly those that exploit pre-NPOESS observations from POES, DMSP, and EOS.

The NDE Product Development Manager advises the NDE Project Manager about product development/enhancement projects that have been approved by the SPSRB and/or by a NESDIS management review process. The NDE Project Manager then determines whether to allocate NDE funds to support the selected product development efforts. Figure 13 (below) shows NDE in the context of the SPSRB as an instance of a “Resource Identification” procedure. NDE is an integral part of the SPSRB process because it is primary funding source for NPOESS product development. The NDE Product Development Manager will rely on the SPSRB’s procedures as a means of documenting and evaluating projects that can most beneficially exploit NPOESS observations.

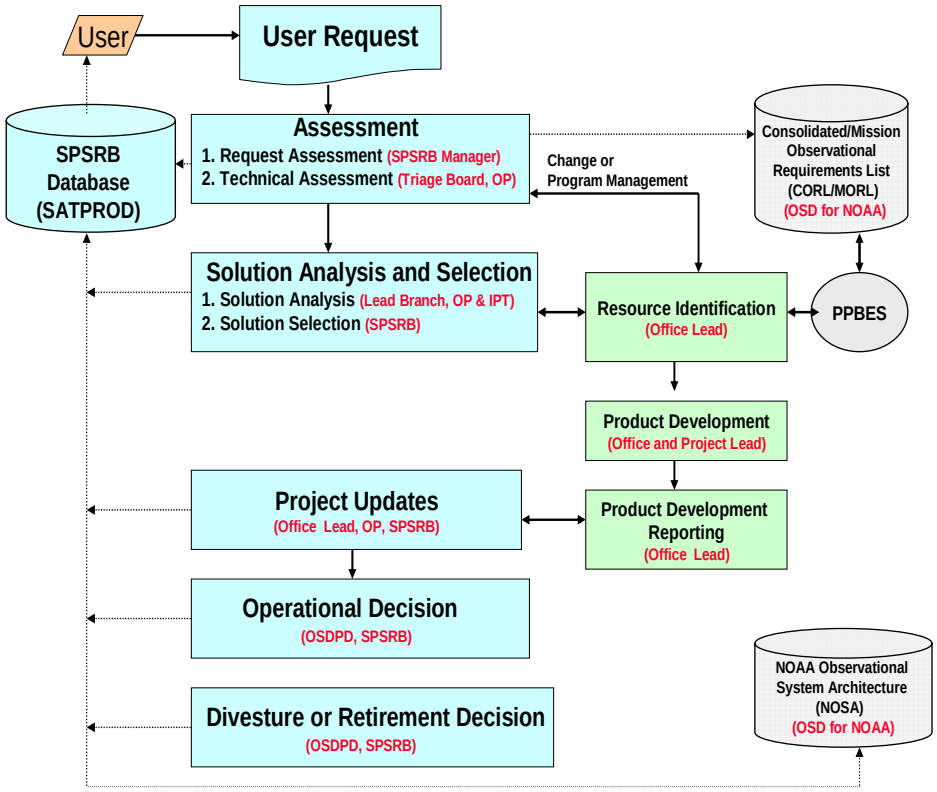


Figure 13: SPSRB Process

8.3.2.2 NDE Management Board

Guidance and direction are provided to the Project Manager once a year by the NDE management Board. The members of this Board include representatives for directors of OSD, OSDPD, and STAR as well as representatives from those Mission Goals and Programs most closely associated with satellite products (Appendix D). NOAA management uses the annual review to ensure a coordinated implementation across the NOAA enterprise. The Board will review all NDE procurement plans and recommend adjustment as appropriate. The NDE Management Board review will occur several months prior to the beginning of the fiscal year, so there will be sufficient time to adjust procurement plans. The Board may also be convened at other points during the year to review milestone deliverables and provide guidance on project direction. The NDE Management Board process will ensure that future procurement activities and associated spending plans are coordinated among NOAA offices.

The roles and responsibilities of the NDE Management Board include:

- Reviewing and prioritizing strategies for NDE acquisition, development, and implementation

- Reviewing NDE spending plans
- Ensuring NDE procurement activities within their offices are submitted and progress is properly tracked by management
- Monitoring progress and resolving conflicts (for example, balancing requirements and priorities between NDE, the Satellite Acquisitions Program, and the Polar Satellite Acquisitions Program).
- Identifying and agreeing sponsors for sub-projects and working groups (If a need for work outside the NDE purview is discovered, the board will help to establish the action teams by assigning someone at their level to get it done. Examples could be teaming with agencies outside NESDIS or NOAA such as NASA.)

The NDE management Board's annual guidance will be based on its evaluation of:

- NDE Project status
- NPOESS product development priorities and plans
- ESPC development priorities and plans
- Detailed procurement plans for the upcoming fiscal year
- Acquisition strategy for the remainder of the project

8.3.2.3 Requirements Management

The NDE System Architect will be responsible for minimizing developmental duplication and ensuring that project resources are used to satisfy approved requirements. The Architect will maintain a Requirements Tracking System (RTS) that will consist of a database associating each requirement with the following:

- Project Categories (product generation, customer service, dissemination, etc.)
- Requesting organizations
- Approval status
- Priority
- Contact information
- Development status
- Associated system features
- Test specifications
- Test plans
- Test status

The ESPC's System Development Team (Section 3.3) will establish procedures to evaluate candidate requirements in terms of suitability for inclusion within NDE's scope. Representatives of the ESPC Team will submit requests for changes to the project's scope through these procedures. The ESPC System Development Team will evaluate the request. The Team will advise NDE Project Management of its recommendations, including cost estimates and risk assessments. For each request, appropriate recommendations are:

- New Requirement Approved
- New Requirement Rejected
- Existing Requirement to be Revised

8.4 Execution Processes

8.4.1 Deliverables and Configuration Management

For each task in the Work Breakdown Structure (Section 6.3.1) submitted for approval by NDE Project Management, the Team Leader will provide a written description of the expected work product (e.g., deliverable). The team member(s) responsible for the task will receive the descriptions when they are assigned the work. Discussions between Team Leaders and Team Members regarding a deliverable's quality, level of detail, and preferred tools should take place at time of assignment.

The Team Leaders are responsible for the quality of all work products. They have discretion, therefore, to conduct as many Quality Control reviews of work products as they feel are appropriate. The time and effort required to conduct these reviews, as well as any anticipated rework that is likely to be identified during the course of the reviews, will be shown on the Work Schedules submitted to NDE Project Management. In other words, quality planning is an element of Work Schedule development.

To reduce the effort associated with defining and explaining the work products, industry standard System Development Life Cycle (SDLC) methodologies may be used.

Configuration Management (CM) has many dimensions. Section 6.3 (above) describes control of executable system components and the specifications associated with them. Here, the control of milestone deliverables is addressed.

NDE Project Management will provide an outline that shows the relationship between the components that make up the milestone review documents that the NDE Senior Management Board (SMB) (Section 6.3.2.1) will review at the conclusion of Build Cycle phases. For example, at the commencement of the Customer Coordination Phase for any Build Cycle, NDE Project Management team will develop a System Requirements Review (SRR) documentation outline (e.g., documentation tree) and a table of contents for each document. Minimally, milestone documentation will consist of final versions of the Integrated Project Plan, System Requirements, System Architecture, and the NDE Concept of Operations.

NDE Project Management maintains consistency of format and content between these documents, between Build Cycles, and between the Phases of a Build Cycle. Strict configuration control will be exercised over documents with SMB signatures; revisions require SMB approval and signature.

8.4.2 Team Management

There will be four permanent, government NDE Team Managers:

- Project Management
- Product Development
- System Architecture
- Transition

Every manager will supervise one or more Teams. Each Team will have a Team Leader. A Team Leader's responsibilities include:

- Defining work products (Section 6.3.1)
- Developing Work Schedules
- Reporting status

- Defining skill sets required by Team Members in order to produce work products
- Monitoring the performance of Team Members
- Arranging assistance for Team Members in the performance of their tasks
- Delivering work products of predefined quality on schedule
- Reporting Team Member performance to the managers responsible for performance evaluations
- Recommending changes of team membership (additions, removals, transfers, etc) for assigning personnel to Teams

8.5 Facilitating Processes (TBC)

8.5.1 Risk and Issues Management

Risk management will use processes defined in the Risk Management Plan.

8.5.2 Vendor & Contract Management

Vendor and Contract Management will use standard Contract Officer (CO) and Contract Officer Representative (COR) processes.

8.5.3 Stakeholder Communication Processes

The NPOESS Data Exploitation (NDE) Stakeholder Communications Team is a matrixed organization with staff drawn, as needed, from many NOAA departments. These teams provide the most important lines of communication between the organizations in which they are employed and the NDE Project. (Figure 6.5) They provide a valuable advice to the NDE Project because they are cross-functional, each with expertise in specialized topics of importance to the Project. Conversely, they provide a valuable service to NOAA by conveying NPOESS questions, issues, and status back to their organizations.

Members may serve on multiple Communication Teams. Members will also be asked to fulfill some of the roles and responsibilities described in Section 6 (below). (Multiple affiliations are typical of a matrixed organization.)

The stakeholder communication teams are kept advised of NDE activities via e-mail and at regular NDE Team Meetings. Each stakeholder communication team leader has the option of assigning and coordinating the efforts of their team members to perform special NDE tasks or respond to Action Items on those occasions when the NDE Project Manager asks them to do so.

The following Stakeholder Communication Teams have been formed. (Team mission statements are described in the NDE Charter http://projects.osd.noaa.gov/nde/prog_mgt.htm) (see Figure 14).

- Architecture and Infrastructure Team
- Archive & Access Team
- Budget Analysis Team
- Direct Broadcast Services Team
- Documentation Team
- External Affairs Team
- Facilities Team
- International Affairs Team
- Instrument Characterization Team
- IPO Interface Team

- Line Office Interface Team
- NOAA-unique Product Validation and Development Team
- NOAA Product Tailoring, Distribution, and Communications Team
- System Test and Evaluation Team
- Web Site Team

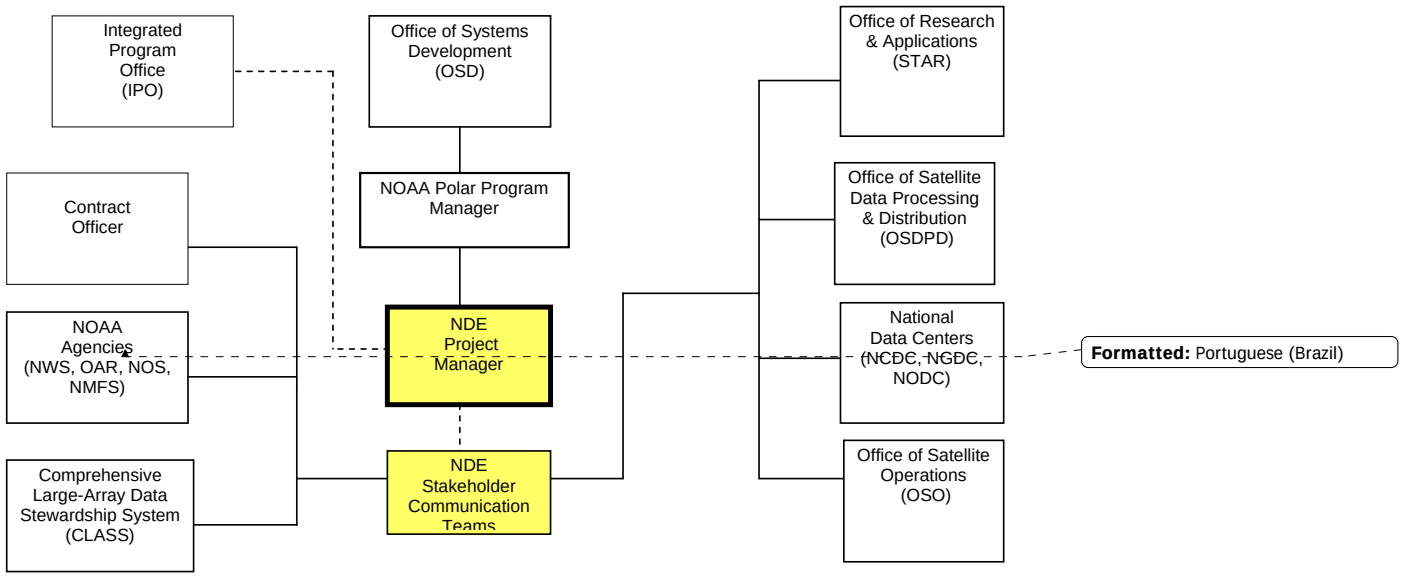


Figure 14. NDE Stakeholder Communication Teams

9 FIVE-YEAR SPEND PLAN

This information is currently unavailable.

APPENDIX A: ACRONYMS AND ABBREVIATIONS

ADCS	Advanced Data Collection System
AFWA	Air Force Weather Agency
APS	Aerosol Polarimeter Sensor
ATMS	Advance Technology Microwave Sounder
AWIPS	Advanced Weather Interactive Processing System
C1	NPOESS First Satellite
C2	NPOESS Second Satellite
C3	NPOESS Third Satellite
CASE	Computer Assisted Software Engineering
CDR	Climate Data Records
CDR	Critical Design Review
CE	Capital Expenses
CLASS	Comprehensive Large Array-data Stewardship System
CM	Configuration Management
CMIS	Conical Scanning Microwave Imager/Sounder
CO	Contract Officer
CONOPS	Concept of Operations
COOP	Continuity of Operations Plan
COR	Contract Officer Representative
CM	Configuration Management
CrIS	Cross-Track Infrared Sounder
CrIMS	Cross-Track Infrared Sounder + Advance Technology Microwave Sounder
DBA	Data Base Administrator
DBMS	Data Base Management System
DCS	Data Collection System
DMSP	Defense Meteorological Satellite Program
DoA	Department of Agriculture
DOC	Department of Commerce
DoD	Department of Defense
DOS	Department of State
DRO	Direct Readout
ECMWF	European Center for Medium-range Weather Forecasting
EDR	Environmental Data Record
EOS	Earth Observing System (NASA)
ERD	Entity Relationship Diagram
ESPC	Environmental Satellite-data Processing Center
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FNMOC	Fleet Numerical Meteorology and Oceanography Center
FOC	Final Operational Capability

HDF	Hierarchical Data Format
HDF5	Hierarchical Data Format version 5
I&T	Integration and Test
IDPS	Interface Data Processing Segment
IORD	Integrating Operational Requirements Document
IPO	Integrated Program Office
IPP	Integrated Program Plan
ITAT	Information Technology Architecture Team
JARG	Joint Agency Requirements Group
JCSDA	Joint Center for Satellite Data Assimilation
KPP	Key Performance Parameter
LTA	Long-term Archive
METOP	Meteorological Operational
MMC	Mission Management Center
NAVOCEANO	Naval Oceanographic Office
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NDE	NPOESS Data Exploitation
NEB	NOAA Executive Board
NGDC	National Geophysical Data Center
NIC	National Ice Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODC	National Ocean Data Center
NOS	National Ocean Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project
NSOF	NOAA Satellite Operations Facility
NWS	National Weather Service
O&M	Operations and Maintenance
OAR	Office of Atmospheric Research
OMB	Office of Management and Budget
OPC	Ocean Prediction Center
STAR	Office of Research Applications
OSD	Office of Systems Development
OSDPD	Office of Satellite Data Processing and Distribution
PD	Product Development
PDR	Preliminary Design Review
PIR	Post Implementation Review
POES	Polar-orbiting Operational Environmental Satellite
POP	Product Oversight Panel
PPBES	Project Planning, Budgeting, and Evaluation System
PPI	Plan For Product Implementation

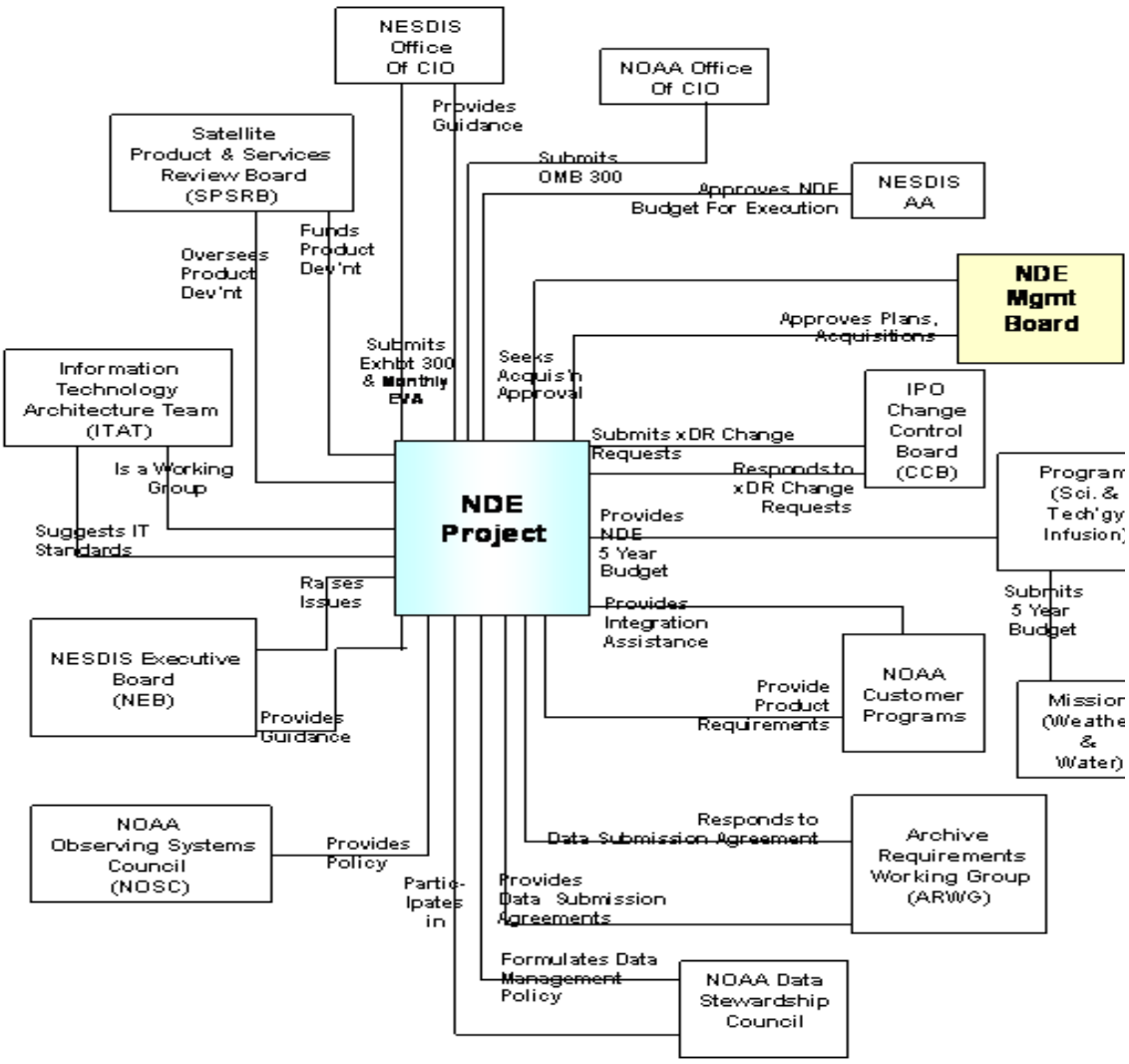
PPI	Program Planning and Integration
PSDI	Product Systems Development and Implementation
R2O	Research To Operations
RDBMS	Relational Data Base Management System
RDR	Raw Data Record
RTS	Requirements Tracking System
SARSAT	Search and Rescue Satellite Aided Tracking
SDLC	System Development Life Cycle
SDR	Sensor Data Record
SDS	Scientific Data Stewardship
SMB	Senior Management Board
SPSRB	Satellite Products and Services Review Board
SRR	System Requirements Review
SST	Sea-Surface Temperature
STI	Science and Technology Infusion
SUAG	Senior Users Advisory Group
TBC	To Be Confirmed
TDR	Temperature Data Record
UKMetO	United Kingdom Meteorology Office
USMCC	United States Mission Control Center
VIIRS	Visible/Infrared Imager Radiometer Suite
WBS	Work Breakdown Structure
xDR	any NPOESS Data Record

APPENDIX B: DEFINITIONS

Acceptance Testing (aka User Acceptance Testing)	the process of verifying that the system is functional, robust, and meets the business/science needs by piloting the system with business/science users
String testing	the testing of a collection of units that have a logical relationship or flow from the user's perspective
System Testing	the process of verifying that the system is completely functional and robust enough for user interaction and use. System testing covers many different aspects including functional testing, volume/performance testing, and multi-user testing.
Unit testing	the testing of a particular, discrete function of the application..

APPENDIX C: RELATIONSHIPS WITH NOAA ENTITIES

Figure 7: Relationships with NDE NOAA



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A Replace pages 3.4-1 through 3.4-10 with change pages 3.4-1 through 3.4-10b@
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